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THE AMERICAN
JOURNAL OF PHARMACY

VOL. 99 MARCH, 1927 NO. 3

EDITORIAL

"PRINTED IN GOOD FAITH"

IN A FORMER issue of this Journal, there was printed in good faith, the following bit of *scientific* (?) news:

> "Sir Jagadis Chunder Bose, Indian botanist, has an idea that plants are as alive and sensitive as animals. He performed experiments which he claimed showed that plants react to cobra venom, cyanide and other poisons and to stimulants such as ether, chloroform and alkaloids, just like animals. The sensitive plant, he declared, is ten times as sensitive as the human tongue. Sir Jagadis says that the plant-heart that propels its sap is a layer inside the stem, similar to the elongated tubular heart-organ in lower animals, operating by pulsation. He showed an optical sphygmograph recording the "pulse" of a plant magnified ten million times by a reflected light beam. Plants, he claimed, have muscles much like those of human beings and that when tickled these are ordered to contract through the "nerves" of the plant. Sir Jagadis further stated that the stimulations of a plant are co-ordinated by a special brain-like tissue at the junction of stem and leaf stalk."

To the average person, interested in *scientific* progress—particularly in view of the fact that the work of Bose was reported at the meeting of the British Society for the Advancement of Science—the item seemed exceedingly plausible and most trustworthy. Besides it had a touch of romance to it. And so it was printed in good faith—and accepted by the reader, in good faith—each a most natural procedure.

But that is just where the rub is.

Too much good *faith*.

Along now, come two scientists—real scientists—who have no time for *faith*—good or bad—and together they hammer the *faithful*

and *high sounding* researches of Jagadis Chunder Bose till the sap is all out of the *timbre*.

And there is a veritable mercilessness to the fighting scientist—who, garbed in his invulnerable coat of fact, can well afford a parade of bravery—and a show of prowess.

Drs. MacDougal and Overton, these two formidable scientists not only wreak their vengeance on Bose and his work, but most unkindly upon all who listened to his story.

Listen——

> "Since the acceptance of Bose's work in America and since it has been widely proclaimed in the popular press of Great Britain, we are led to say that such recognition of Bose's work on ascent of sap and the nervous mechanism of plants has been confined to persons of non-scientific training, political propagandists and literary reviewers, whose capacity for judgment, motives and purposes may not be adequately discussed here."

That is only a fraction of what they say in a special article in *"Science,"* and as one of those editors who lent space to Bose's communications we wonder just how to label ourselves and how to appraise our "capacity for judgment." Perhaps we had better not try and so we go on with the rest of the story. The article proceeds:

> "Bose's conclusion that the wood serves as a reservoir from which living cells draw water and pump it by pulsating action not through wood, but from protoplast to protoplast at the rates given would imply transfer through two to four hundred living cells per second is too fantastic to be the subject of any serious comment.
>
> "To ascribe rhythmic variations in galvanometer readings connected with probes pushed into cortical layers as due to hydrostatic pulsations is to throw aside all the safeguards of research. With Bose's suggestion that these pulsations may be the result of stimulation by friction of the roots with soil particles it is realized that the passage from pseudo-research to infantile fancies is an easy one. A sympathetic exposition of the Bose Institution and of the work of its director reprinted in *The Garland* (Calcutta) for May, 1926 (edited by S. M. Swaminathaiyer) includes the following passage: 'For the mysteries of nature are probed in Sir Jagadish's institute not by study of libraries or by mechanical experiments, but primarily by communion with the unseen and the unknown. Inspiration, imagination, intuition, vision, this is an even more romantic touch.'

> "The correctness of this characterization is attested by every page of Bose's book on the ascent of sap, which is utterly lacking in scientific significance. Such books appearing on the lists of scientific publications constitute a menace and danger to sound science."

And now that we have both sides of the question, it seems that the problem resolves itself to choosing between the researches of two diligent workers interested in truth and truth only—and another whose information comes from communion with the "unseen and unknown"—with the "intuitive and the imaginative."

And, in a scientific way, the choice is very easy to make.

IVOR GRIFFITH.

SELECTED EDITORIAL

BORIC ACID AND A HOSPITAL ACCIDENT*

OCCASIONALLY the world is startled when, by some fortuitous circumstance, death comes suddenly to human beings. Chicago has recently provided two such instances of medical importance. A landlord used cyanic gas to fumigate a vacant apartment. A mother and baby sleeping in the apartment above died of the inhalation, and the landlord, in his grief, committed suicide. In a hospital, through a confusion of technic among three nurses, infants in the nursery were apparently given boric acid solution instead of drinking water and six died. Probably such an accident would not happen soon, if ever again. But as long as there are human beings handling devices or drugs of possible danger, accidents will occur.

New interest is created for the moment in the potentialities of boric acid as a poison. Compared with phenol, cresol, or mercury preparations, it is relatively non-poisonous. Cases are recorded, however, of the death, even of adults, when considerable quantities of saturated boric acid solutions have been introduced into the body. If a drug is to be antiseptic, it must have some toxic properties. But in the present instance babies weighing about seven pounds (3.2 Kg.) each may have received from 15 to 60 cc. of a saturated solution in twenty-four hours, or approximately 0.8 to 3 Gm. of

* Reprinted from the *Journal of the American Medical Association.*

boric acid. In reported cases, from 1 to 3 Gm. have produced serious symptoms, and from 15 to 30 Gm. have been fatal to adults.

The deadly character of cyanic gas and cyanides has already led to the enactment in some jurisdictions of laws limiting sales and even forbidding the use of the gas for disinfecting purposes except as may be specially authorized by the proper authorities in each case. The tragic deaths of these babies from boric acid is not unlikely to lead to the promulgation of rules by hospital authorities to safeguard the drinking water supplied patients against similar mishaps, whether from boric acid or more dangerous substances.

Boric acid is so frequently used as a household article that its power for harm is ordinarily overlooked. Yet its potential danger is such that its use as a food preservative has long been forbidden in the United States, France, Germany, Holland, Italy and Spain. Only recently its use has been forbidden in Great Britain by the ministry of health, acting on the basis of a prolonged investigation of various methods of preserving food. Boricized milk, it was reported had caused serious bowel disorder in infants. With such facts as these in mind, it does not seem remarkable that boric acid given in water to new-born infants should cause death, however tragic and startling the mishap may be.

Fatalities to many persons through the failure of an engineer in charge of a train, an usher in a theatre, the captain of a boat, the elevator man, or a cook are not infrequent. They become the news of the day and in the rush of modern life pass soon into the limbo of forgotten things. The deaths of six infants in a hospital to which mothers came for the safe care that a hospital should provide must not be permitted to pass without the lesson of the accident being driven home to the personnel of every hospital in the country. The guardians of the well have only a partial responsibility; the caretakers of the sick and of the infant have responsibility that is complete, that demands eternal vigilance, that permits no escape. Their responsibility cannot be lightly assumed and, once taken, must be borne to the utmost of human strength and wisdom.

ORIGINAL ARTICLES

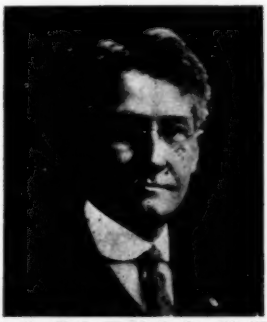
THE ROMANCE OF THE OCCULT*

By Charles H. LaWall, D. Sc., Ph. M.,

Professor of Pharmacy, Philadelphia College of Pharmacy and Science

"Error is always more busy than ignorance.
Ignorance is a blank sheet on which we may write, but error is a scribbled one from which we must first erase."—*Colton.*

WHAT is occultism? What are the occult sciences? The word "occult" has had many meanings. Occult science or occult philosophy in the Middle Ages was simply experimental science. This did not necessarily include magic, but as experimental science in either physics or chemistry in this older period was so mysterious in its effects, the ignorance and superstition of the time invested the practitioners with supposed supernatural qualities and associations, and as there is apparently no limit to human credulity, the literature of alchemy, medicine, and pharmacy, from the eighth to the eighteenth century, is a bewildering mixture of fact and fancy. Even the later centuries have not been free from reproach in this respect, for Tyndall says:



Charles H. LaWall, D. Sc., Ph. M.

> "Were the characters which superstition assumes in different ages an indication of man's advance or retrogression, assuredly the nineteenth century would have no reason to plume itself in comparison with the sixth B. C."

The modern use of the word "occult" is either in connection with something "mysterious or transcendental" or "passing beyond the bounds of scientific knowledge," or else it is applied to something that is "not apparent upon mere inspection or deducible from what is so apparent," and its meaning is "opposed to manifest." If we take this latter definition literally, hash might be legitimately considered

*One of a Series of Popular Science Lectures given at the Philadelphia College of Pharmacy and Science, 1926-27 Season.

to be an occult product. The sense in which it is used in this connection is when it is applied to "occult" blood in urine or feces.

For the purpose of this lecture I shall take the first of these meanings and shall attempt to describe some of the interesting phases and varieties of misbeliefs and superstitions which have made so alluring the literature of these older periods, when myths and legends were pandemic and when the phenomena which are commonplace to us were enveloped in a halo of mysticism and magic. Lang says: "The narrower the range of man's knowledge of physical causes, the wider is the field he has to fill up with hypothetical causes of a metaphysical or supernatural character."

The psychological effect of words is often profoundly stimulating to some subconscious, unverbalized feeling which is common to the great majority of the human race. The terms "esoteric," "cabalistic," "arcane," "hermetic," "magic," "mystic," and others of similar character, possess a compelling appeal to many individuals who lose their mental bearings as soon as they are exposed to the sound or the sight of them. So, too, the words "fairy," "dryad," "faun," "satyr," "witch," "wizard," "warlock," "necromancer," "sylph," "salamader," "undine," "nymph," and "gnome," and many others, conjure up memories and impressions, elusive and fascinating in their mysterious indefiniteness.

When Peter Pan advances to the front of the stage in Barrie's famous play of that name, and appeals to all of those in the audience who believe in fairies to applaud, and thus save the life of Tinker Bell who is fading away because of lack of faith in fairies on the part of the audience, many who respond do so perfunctorily, but there are those in every audience who *do* believe in elves and sprites and the power of fern seed to confer invisibility upon the possessor, and for these select few fairies do and always will exist.

I find myself confronted with such a voluminous wealth of material that I shall have to skim over many of the subjects in a synoptical manner and confine myself to outlines and definitions mainly, sketching a picture as I go along and leaving my hearers to fill in the details later if they so desire.

"Error is a Hardy Plant, it Flourishes in Every Soil." Magic is the first subject that comes under the head of the occult sciences. There are many subdivisions of the art, among which are white magic, black magic, ceremonial magic, and red magic.

MAGIC

The word "magic" comes from a root word meaning priest. A "mage" or "magus" was one of the priestly caste of wise men of the Medes and Persians, and this was the group from which Caspar, Balthasar and Melchior came to the nativity of Christ in Bethlehem. "Magism" is the philosophy of the magi.

A Group of Famous Occulists, from a Work by John Dee

Eliphas Levi, an occultist of the nineteenth century, defines magic as "the traditional science of the secrets of nature which has come down to us from the Magi." By this is meant the Magus

> "Who uttered his oracles sublime
> Before the Olympiads in the dew
> Of early dawn and dusk of time."

Chaldea was the cradle and the sanctuary of the transcendental sciences. The magicians of Egypt played an important part in the controversy between Pharaoh and Moses over the departure of the children of Israel, but Moses and Aaron seem to have been able to hold up their side of the argument with their magical arts.

Title Page of a Modern Book Upon Occult Subjects

The epistemological aspects of magic have led to the publication of many historical and philosophical works during recent years upon various phases of occultism, but there has also appeared a voluminous literature which appears to have for its object the encouragement of those who seek to accomplish results by the use of occult methods.

Pneumatology, from the Greek *pneuma,* air, and *logos,* to speak,

is the study of the beliefs, practices, and organizations of men with reference to a supposed world of spirits. This includes comparative mythology, spiritology, and daimonology.

White magic is beneficent magic. One of its principal objects is the evocation of angels. This brings us to the consideration of what is an angel.

WHITE MAGIC. THE EVOCATION OF ANGELS

Angels are the messengers of Christian tradition. The rabbinical commentary on Genesis by Rabbi Jacob says "the angels have no free will and cannot be otherwise than good." They respond to evocations, perform miracles, garner the prayers of the faithful, overwatch human beings and engage in an everlasting spiritual warfare with the powers of darkness. The "Incommunicable Name" is a fountain or arcane power in this evocation and the Hebrew alphabet plays a significant part.

THE SEVEN STEWARDS OF HEAVEN

There are seven Stewards of Heaven: Arathron, Bethor, Phaleg, Och, Hazith, Ophiel, Phul. There are 196 Olympic regions over which they reign. For example:

> "Arathron is the celestial spirit of Saturn; he can operate natural things prepared by astrological influences; he may change everything ,into stone, whether animals or plants, but they will preserve their exterior appearance. He changes treasures into coals and coals into treasurers. He gives familiar spirits with definite power; he teaches alchemy, magic, and natural philosophy; he joins men to gnomes and earth spirits; he renders people invisible; he governs fertility and conception; he teaches the discovery of lead, its manipulations and its changes into gold; he teaches the art of curing the smaller animals of their diseases, such as goats, poultry, etc. He gives intelligence of prisoners and of sick people, despatches ministering spirits, who serve after his own manner, enlarges the understanding, gives excellent advice on all elevating subjects, and is most exact in his calculations. He must be evoked on a Saturday, at the first hour of sunset in the increasing moon."
>
> And so on down the entire list.

There are nine steps of preparation or indispensable attributes for successful evocation of angels, among which are the following:

> "The magus must be useful to his neighbors and glorify his Maker. He should be discreet and faithful and should never reveal what he has been told by a spirit. He should avoid all superstition, which consists in the attribution of divine power to

things which are without divinity. He must avoid the deceitful imitations of the devil, who, by the perversion of the theurgic powers concealed in the Word of God, becomes a fraudulent imitator of things which belong to God. He must present himself with a pure heart, an undefiled body, and innocent hands. After bathing and fasting for three days he must seek a retired spot, where, free from observation, he can recite certain prescribed invocations."

THE EVOCATION OF THE SPIRITS OF THE ELEMENTS

The magical doctrines of the evocation of the elements has furnished the material for some of the most popular and attractive fictions in literature, such as Pope's *Rape of the Lock, Undine* by Foqué, Burton's *Arabian Nights,* and the works of Spenser, Ariosto, Goethe, Schiller, Keats, Washington Irving and Hawthorne. Algernon Blackwood, Sax Rohmer, and Bram Stoker are modern writers who deal with various phases of occultism. To quote from Pope:

"Some secret truth from learned pride concealed,
To maids alone and children are revealed."

"Know then unnumbered spirits round thee fly,
The light militia of the lower sky."

"The spirits of fiery termagants in flame,
Mount up and take a salamander's name."

"Soft yielding minds to water glide away,
And sip with nymphs their elemental tea."

"The graver prude sinks downward to a gnome,
In search of mischief still on earth to roam."

"The light coquettes in sylphs aloft repair,
And sport and flutter in the fields of air."

"For spirits, freed from mortal laws, with ease
Assume what sexes and what shapes they please."

There are said to be four classes of "elements" (or elementals) with intelligences, normally unseen, some of them friendly to man and some of which are his deadly enemies. They are without souls. Their lives depend upon the continuance of some natural object, hence they are without immortality. An elementary spirit may procure a soul by a loving union with some one of the human race. The reverse effect is sometimes produced and the soul of the mortal is forever lost.

The four elements handed down from the time of Empedocles, earth, air, fire, and water, each has associated with it a sub-human intelligence. The earth is inhabited by gnomes; the air is populated with sylphs; fire is associated with the exalted and glorious nation of salamanders; the waters are filled with the delightful and beautiful undines, or nymphs.

AIR; EARTH; FIRE; WATER

Robert Fludd, an English Rosicrucian and mystic, connected these groups of intelligences with certain angelical choirs. Thus the cherubim are terrestrial, the principalities are aerial, the seraphim are of a fiery character, and the archangels are aquatic.

A work of the Abbé de Villars called "Comte de Gabalis," published at the close of the eighteenth century, gives a popular presentation of the elementary spirits, in which he says:

> "The salamanders are composed of the most subtle parts of the spirit of fire, conglobated and organized by the universal fire, so called because it is the principle of all the motions of nature. In the same manner the sylphs are composed of the purest atoms of air, nymphs of the most ethereal particles of water, and gnomes of the most refined earth. The primeval Adam was in correspondence with these perfect creatures, because, being composed of the finest matters of the four elements, he contained in himself the physical perfection of each of these four races, and was therefore their natural king. But when sin had precipitated him among the excrements of the four elements, this harmony was shattered, he became gross and impure, and no longer bore any relation or proportion with these so pure and subtle substances."

Formulas and methods are given by this author for recovering the empire and control over the four classes of elementals, as they are usually called. Paracelsus devoted much space to the consideration to the spirits of the air or sylphs, and a method for the control and interrogation of elementary intelligences is given by Eliphas Levi. Eliphas Levi was a French mystic and magus of the nineteenth century, who wrote many works on occultism, among which were the *Dictionary of Christian Literature,* the *Doctrine and Manual of Transcendental Magic,* the *Sorcerer of Mendon, The Major and Minor Keys of Solomon,* and other works of the same character. The name "Eliphas Levi," to which is sometimes added that of "Zahed," is the *nom de guerre* of an apostate French priest named Alphonse Louis Constant, who was born about 1810 and died in 1875.

Levi states that:

"The air is exorcised by the sufflation of the four cardinal points, the recitation of the Prayer of the Sylphs and the following formula:—The Spirit of God moved upon the water, and breathed into the nostrils of man the breath of life. Be Michael my leader and be Sabtabiel my servant, in the name and by the virtue of light. Be the power of the word in my breath, and I will govern the spirits of this creature of Air, and by the will of my soul, I will restrain the steeds of the sun, and by the thought of my mind, and by the apple of my right eye. I exorcise thee, O creature of Air, by the Pentagrammaton, and in the name Tetragrammaton, wherein are steadfast will and well directed faith. Amen. Sela. So be it.

"Water is exorcised by the laying on of hands, by breathing, and by speech, mixing consecrated salt with a little of the ash which is left in the incense pan. The aspergillus is made of branches of vervain, periwinkle, sage, mint, ash, and basil, tied by a thread taken from a virgin's distaff, with a handle of hazelwood which has never borne fruit, and on which the characters of the seven spirits must be graved with the magic awl. The salt and ashes of the incense must be separately consecrated. The prayer of the Undines should follow.

"Fire is exorcised by casting salt, incense, white resin, camphor, and sulphur therein, and by thrice pronouncing the three names of the Genii of fire—MICHAEL, king of the sun and of the lightning; SAMAEL, king of volcanoes; and ANAEL, king of the Astral Light; then by reciting the prayer of the Salamanders.

"The earth is exorcised by the sprinkling of water, by breathing, and by fire, with the perfumes proper to each day, and the prayer of the Gnomes.

"It must be borne in mind that the special kingdom of the Gnomes is at the north, that of the Salamanders at the south, that of the Sylphs at the east, and that of the Undines at the west. They influence the four temperaments of man, that is to say, the Gnomes influence the melancholic, Salamanders the sanguine, Undines the phlegmatic, and Sylphs the bilious. Their signs are—the hieroglyphs of the Bull for the Gnomes, who are commanded by the magic sword; of the Lion for the Salamanders, who are commanded with the forked rod, or magic trident; of the Eagle for the Sylphs, who are ruled by the holy pentacles; and, finally, of Aquarius for the Undines, who are evoked by the cup of libations. Their respective sovereigns are Gob for the Gnomes, Djin for the Salamanders, Paralda for the Sylphs, and Necksa for the Undines.

"Like so much of occult nomenclature, these names are of a generic and arbitrary kind, and appear to be devoid of real im-

portance; in the present instance, they are borrowed from folklore.

"It must be remembered that the words 'Elemental' and 'Elementary' are not exactly controvertible terms; as the latter is frequently used by 'theosophists' to denote the astral remains, or 'shell,' of a deceased person who has led a gross and evil life on earth, and whose vanishing personality remains for some time in the earth atmosphere, seeking to annoy the living.

"When an elementary spirit torments, or, at any rate, troubles, the inhabitants of this world, continues Eliphas Lévi, it must be adjured by air, water, fire, and earth, by breathing, sprinkling, the burning of perfumes, and by tracing on the ground the Star of Solomon and the sacred Pentagram. These figures should be absolutely correct, and drawn either with the ash of consecrated fire, or with a reed soaked in various colours, mixed with pulverised loadstone. Then, holding the pentacle of Solomon in the hand, and taking up by turns the sword, rod, and cup, the Conjuration of the Four should be repeated.

"This Conjuration should be preceded and terminated with the sign of the cross, made after the Kabbalistic manner. Raising the hand to the forehead, the Magus should say: 'Thine is,' then, bringing it to the breast, 'the kingdom'; transferring it to the left shoulder, 'justice'; finally to the right shoulder, 'and mercy'; then, joining both hands, 'through the generating ages.'

"To conquer and subjugate the elementary spirits, we must never be guilty of the faults which are their characteristics. Never will a capricious and changeable mind be able to rule the Sylphs. Never will a soft, cold, and fickle disposition be qualified to govern the Undines; anger irritates the Salamanders, and gross covetousness makes those whom it enslaves the sport and plaything of the Gnomes. But we must be prompt and active, like the Sylphs; pliant and observant as the Undines; energetic and strong like the Salamanders; laborious and patient, like the Gnomes: in a word, we must overcome them in their strength without ever being overcome by their weakness."

—From *The Occult Sciences,* by A. E. Waite.

Medieval magic is filled with the histories of familiar spirits attached to the persons of magicians. They perform all commands without any apparent reward and without exacting any of the spiritual sacrifices usually supposed to be required from dealers with the supernatural, as exemplified in Faust.

The metals which correspond to the elementals are gold and silver for air, mercury for water, iron and copper for fire, and lead for earth. Divination by the aid of these elementals is called aeromancy,

hydromancy, pyromancy, and geomancy, respectively, for air, water, fire, and earth.

In this same connection must be mentioned a number of terms encountered in literature, both poetry and prose. An oread is a mountain nymph, a dryad is a nymph of the woods, and each tree was supposed to be the home of a member of this group. Hawthorne says, in one of his fanciful tales: "Knock at the rough rind of this ilex tree and summon forth the dryad," while Longfellow, in commenting upon the nomenclature of the principal streets of Philadelphia, says: "There the streets still re-echo the names of the trees of the forest, as if they fain would appease the dryads whose haunts they molested." A hamadryad was a wood nymph who lived and died with the tree she inhabited. A nymph was one of a numerous group of inferior divinities who took the form of beautiful maidens, eternally youthful. A naiad was a nymph of the springs, while a nereid was a nymph of the seas. A nixie was a swan maiden.

A troll in Icelandic literature was a giant, but in Scandinavian folk lore is a diminutive being which can render itself invisible and which keeps up a friendly intercourse with human beings. Trolls are sometimes obliging and at other times malicious or mischievous. They resemble the brownies of Scotland.

The Malay word "jin" corresponds to the Arabic "djin," "jinn," or "jin," which stood for fairies who, according to the Arabian fable were created from smokeless fire 2000 years before Adam was made of earth. They are generally supposed to be evil spirits and are governed by King Solomon.

One of the factors of white magic, according to some authorities, is a complicated symbolic design representing Parabrahma or "the unmanifested absolute," if you happen to know what means.

BLACK MAGIC. THE EVOCATION OF DEMONS

Black magic, or Goetic magic, as it is sometimes called, from the Greek root word for sorcery, is concerned with the evocation and liberation of malign forces. White magic was permissible: black magic was forbidden. The result was that much that passed current as white magic was merely a disguised goeticism, and the impatient magus who failed to follow minutely the ritual details might be surprised to find the resplendent angels bearing horns and cloven hoofs and find himself forever in the power of diabolical and malign forces.

Demons are said to be fallen angels. Some authorities fix the fall before the creation of the present physical world, others with unqualified assurance place the time as the second day of creation. Milton gives graphic details of the combat between the forces of the upper and nether worlds.

There is a wide gap between the daimon of Socratic philosophy and the arch fiend of the Black Sabbath. The word "demon" originally meant a tutelary deity or a god of lower rank. Later it came to mean a ghost or a departed soul. Not until Christianity of the early centuries attempted to find a place for the divinities of the pagans did the word demon come to have a sinister meaning. The demon of Socrates was a good genius; the demon of Poe's *Raven* was malevolent.

There were no evil demons in pre-Christian times. Milton apparently confuses the demons with the elementals described under white magic, for he says in *Il Penseroso:*

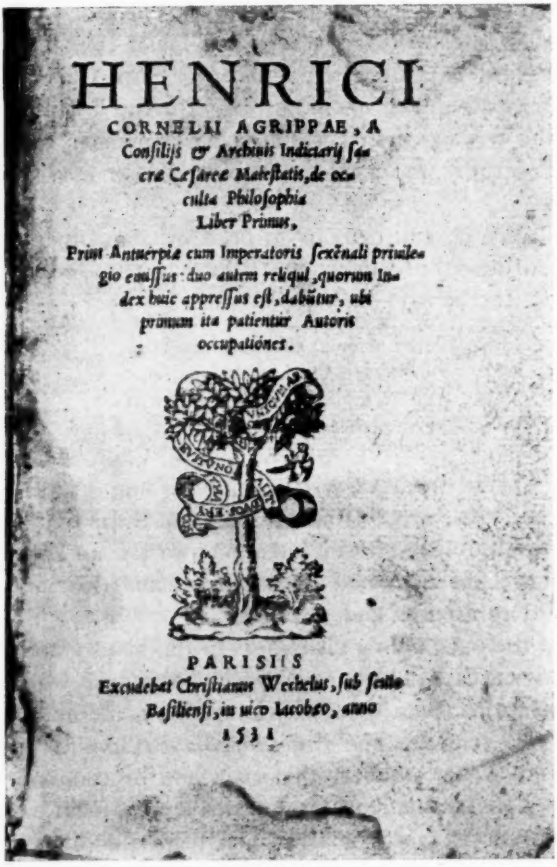
> "Those demons that are found
> In fire, air, flood or underground,
> Whose power has a true consent
> With planet, or with element.

Much of the medieval credulity regarding magic, both white and black, doubtless arose from the fact that some of the authorities who were revered as possessing arcane powers were either connected with the church or protected by its favor, and their works abound with Biblical references and examples.

One of the outstanding characters in the history and romance of the occult sciences was Henry Cornelius Agrippa von Nettesheim. He voluntarily decapitated and curtailed his name and he is known as Cornelius Agrippa. The *Encyclopedia Britannica* refers to him as "a German writer, soldier, physician, and by common reputation, a magician." His life story is a romance in itself. Although a professed mystic who was interested in theosophy and who lectured on the secret doctrines of Hermes Trismegistus at the University of Pavia, he also taught theology for many years and remained a professed Catholic to the time of his death. His most famous work was *De Occulta Philosophia,* the publication of which the Inquisition attempted to suppress without success.

This work was translated into a number of languages in the sixteenth century and modern editions of it have been published.

Agrippa, in the preface to his book, warns the reader against taking the name of magic in a bad sense. He admits that he is a magician, but denies that he is a sorcerer. In his letter to John Trithemus, an abbott of Herbipolis, to whom he entrusted the manuscript and by whose authority it is said to have been published, he warns against


HENRICI
CORNELII AGRIPPAE, A
Consiliis & Archivis Indicarij Sa-
cre Cæsareæ Maiestatis, de oc-
culta Philosophia
Liber Primus,
Primi Antuerpiæ cum Imperatoris sexēnali priuile-
gio emissus: duo autem reliqui, quorum In-
dex huic appressus est, dabūtur, ubi
primum ita patientur Autoris
occupatiónes.
PARISIIS
Excudebat Christianus Wechelus, sub scuto
Basiliensi, in vico Lucobico, anno
1531

Title Page of a Noted 16th Century Work on the Occult Sciences

false philosophers who by superstitious and dangerous rites bring discredit upon magic. In Trithemus' letter of reply to Agrippa he warns him to "communicate high and secret things to high and secret friends only." In 1531 Agrippa's book was published with a dedication to Herman of Wied, Archbishop of Cologne.

One of Agrippa's disciples, Wierus by name, amplified his master's work and has given us a tabulated statement of the whole Satanic monarchy, which is associated with black magic. These are divided into six groups. The first of these includes princes and grand dignataries of whom Beelzebub is "Supreme chief of the Infernal Court and Empire, and Founder of the Order of the Fly." Satan occupies a subordinate position, being entitled "Leader of the Opposition." Moloch is "Lord of the Land of Tears." Pluto is "Lord of Fire," and Proserpine is "Arch-she-fiend and sovereign Princess of Perverse Spirits."

Among the ministers Baal, who is "Commander in Chief of the Infernal Armies," and also Leviathan, "Lord High Admiral, Knight of the Fly." Lucifer is "Lord Chief Justice," and Alastor is "Commissioner of Public Works." There is also a list of Members of the Household and Masters of the Revels, and even ambassadors to various European countries, Mammon being ambassador to England, and Belial ambassador to Turkey.

The "Order of the Fly" referred to in the titles of the members of the nether empire goes gack to the times of the Egyptians and the Greeks. In the temple at Actium the Greeks used to sacrifice an ox annually to the God of Flies, and Beelzebub was a Syrian god known at that time as the Prince of Flies.

Several famous books were published in the eighteenth and nineteenth centuries on black magic. One of these was the *Grimoire,* or *Book of Conjuring and Sorcery,* by Pope Honorius, published in Rome in 1760. The *Grimoire Verum* and *Grand Grimoire* were similar books which appeared in the next century. The strange and interesting part of black magic is the fact that diabolical practices are invariably prefaced by long and solemn prayers, which emphasize the purity of the magician's intention. A modern writer states that "black magic in its esoteric aspect is a barbarous perversion of legitimate mystic science."

The materials required for the evocation of demons are a certain red stone called ematille, a virgin kid which must be crowned with vervain and decapitated on the third day of the moon, a forked branch of witch hazel which has never borne fruit and which must be cut at sunrise on the day of the evocation. A piece of lodestone is also necessary. A preliminary invocation in connection with this paraphernalia is as follows:

"By the Grand Adonay, Eloim, Ariel and Jéhovam, I bid thee be united to, and I bid thee attract all substances which I shall require through the night of sublime Adonay, Eloim, Ariel and Jéhovam. I command thee by the antagonism of fire and water to separate all substances as they were separated on the day of the world's creation. Amen.

"The place of evocation must be a forlorn and isolated spot, and the time night. Thither he must transport the rod, the skin of the kid, the stone called ematille, two vervain crowns, together with two candlesticks and as many candles of virgin wax, made by a virgin girl, and duly blessed. He must take also a new steel and two new flints, with sufficient tinder to kindle a fire, likewise the half of a bottle of brandy, some consecrated incense and camphor, and four nails from the coffin of a dead child. The great Kabbalistic circle must be formed with strips of the kid's skin, made fast to the ground by means of the four nails. Then, with the stone called ematille, a triangle must be placed within the circle, beginning at the eastern point. In the centre of this figure the operator must take up his place; he must deposit the two candlesticks and the two vervain crowns on the right and left of the triangle. The candles should then be lighted, and a brazier, which must be in front of the operator, must be heaped up with charcoal of willow wood, and kindled with the help of a small quantity of the brandy and a part of the camphor, the rest being reserved for the periodical renewal of the fire in proportion to the length of the business.

"Many conjurations are given in the rituals, and these are to be used in succession till the apparition of spirit is obtained. The most powerful, as it is also apparently the most senseless, may be cited as a specimen of the whole.

"Grand Conjuration.

"(Extracted from the veritable Clavicle.)

"'I adjure thee, O Spirit! by the power of the great Adonay, to appear instanter, and by Eloim, by Ariel, by Jehovam, by Alga, Tagla, Mathon, Oarios, Almouzin, Arios, Membrot, Varios, Pythona, Magots, Salphæ, Gabots, Salamandræ, Tabots, Gnomus, Terræ, Cœlis, Godens, Aqua, Gingua, Janna, Etitnamus, Zariatnatmit, etc., A.. E.. A.. J.. A.. T.. M.. O.. A.. A.. A.. M.. V.. P.. M.. S.. C.. T.. G.. T.. C.. G.. A.. G.. J.. F.. Z.. etc.'

"The manifestation of the spirit is guaranteed after a second repetition of these sublime words, when the operator may demand what he requires, and enforce it by the terrors of the Blasting Rod, which tortures all Infernals when it is plunged into the consecrated flame. The demon is generally ordered to discover the nearest buried treasure, which is done on the condition that the secret is kept inviolate, that the Magus is charitable to the poor, and that he receives a gold or silver coin on the first day of every month.

"If the operator was deterred by the extreme difficulty of complying with the ceremonial requirements of Black Magic, but not dismayed by the character of its proceedings, his masters in infernal knowledge could provide him with a simpler ritual at an increased personal expense. He was free to compound with perdition for a slightly less elaborate performance, if he would enter into a compact with the fiend whom he chose to evoke, and dispose of his soul in eternity for certain defined favours, invariably of a paltry character, which hell would guarantee him in time. The particulars of this process were contained in the 'Sanctum Regnum,' or the 'True Method of making Pacts with all Spirits whatsoever.' "—(From *The Occult Sciences* by Waite.)

Natural Magic is the kind that is performed by so-called conjurors and magicians who simply take advantage of natural laws in a secret and mysterious way for the purpose of deceiving the observer. Natural magic also includes the kind of experiments in physics or in chemistry which may be employed to mystify the uninitiated.

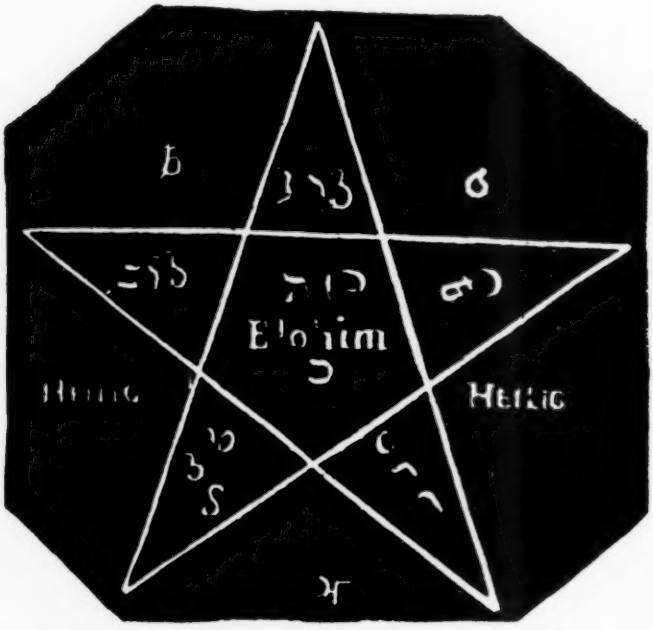
Red Magic is the highest kind of esoteric magic, known only to the initiated and concerning which nothing is written or told.

Ceremonial Magic. This includes white magic and black magic, which have already been discussed. It also comprehends necromancy, which is the evocation of the spirits of the dead; the mysteries of the pentagram and similar figures reputed to possess magical properties; the consecration of talismans; witchcraft, and transformations.

Necromancy. This is a form of magic in which ceremonies and rituals are used to evoke the shades of the departed. This branch of magic is divided into two kinds—the necromancy of light, in which prayers, pentacles, and perfumes are used, and the necromancy of

darkness, in which blood, imprecations, and sacrileges are employed. Swedenborg was a famous necromancer or at least communicated habitually with deceased persons. These evocations are accompanied by elaborate ritual and ceremonies. In some cases the preparatory period is of twenty-one days' duration.

Black necromancy goes back in its history to the time of the Sorcerers of Thessaly. A pit was first dug, and on its brink a black sheep was killed; then certain evil spirits who come to drink the blood are driven away by the magic sword. Hecate and other infernal gods were then called upon and triple invocations of the desired shade followed.



Example of the Pentagram with Cabalistic Characters and Words

In the Middle Ages the black necromancers practiced ghoulish rites and after profaning tombs compounded their unguents and philtres with the grease and blood of corpses. These ingredients were compounded with aconite, belladonna, and poisonous fungi.

These repulsive combinations were heated over fires fed by human bones and stolen crucifixes. As a final touch they added the ashes of stolen consecrated hosts and the dust of dried toads.

The *Pentagram* or pentacle is the five pointed star. This mathematical figure has had an association with the occult from the earliest times. It was used as a symbol by the Pythagoreans, who began their letters with it.

The Seal of Solomon, which consists of two interlaced isosceles triangles is also credited with esoteric powers, particularly in warding off malign influences. The Seal of Solomon is sometimes erroneously called a pentagram. The word "pentacle" is sometimes loosely applied to any talisman bearing a geometrical design.

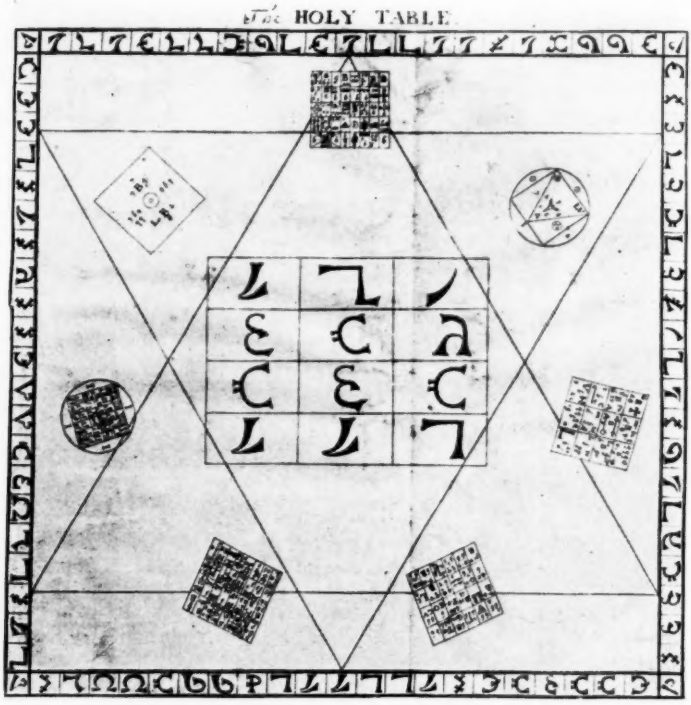
The Pentagram is the star of the Magi. According to its position, it represents good or evil, order or disorder, initiation or profanation, Lucifer or Vesper, Mary or Lilith, light or darkness, victory or death. With one angle ascendant and two pointing downward it is the sign of the Saviour and symbolizes all that is good and perfect. With two angles in the ascendant and one pointing downward it represents Satan, or the Goat of the Sabbath.

Both the Pentagram and the Seal of Solomon are employed in a traditional, if not an actively superstitious manner, in the Pennsylvania German section of the eastern part of the United States, outlined on the gable ends or sides of barns and outbuildings as a protection against disease or injury to the cattle or crops contained therein.

The Pentagram, to be efficient for evocational purposes, should be accompanied by certain arcane words and symbols. Among these the most potent is the Tetragrammaton, or mystic word of four letters. An example of such a word is the name "JeHoVaH," as written with four Hebrew letters. The mirific or wonder-working word is known only to the initiated. It is said that he who knows the true pronunciation of the word has unlimited power over unseen things. This name was said to have been one of the secrets of the Holy of Holies of ancient Israel. Its use is perilous to the uninstructed. The sacred word *Om,* derived from the Sanskrit, is invested with peculiar sanctity in the Hindu and Buddhist religions. An example of its use in Malaysia, chanted by the *bomor* or medicine man, for use in cases of snake bite or stings of centipedes and scorpions, is as follows:

"Peace be with you!
OM! Potent this charm!
Fain would I charm this into the flesh,
The reins, the sinews,
Charm this into the bones!
Charm given of Allah, given too of Muhammed,
The Apostle of God."

Talismans have always played an important part in magic. Some of these have been published in various works upon the subject. One work which is rich in ceremonial rituals and symbols which has never been reproduced in modern times is the *Enchiridion* of Pope Leo III.



Mystical Table from Work by John Dee

Many works have been reproduced purporting to be derived from the time of King Solomon. These are known as *Claviculæ*.

Paracelsus of medical, pharmaceutical, and chemical fame, is an imposing magical authority. He is said to have used, but did not publish, the ceremonial ritual for many occult practices, and he was

a user of and believer in talismans. One of the most widely known of talismanic figures is the celebrated "abracadabra," which is known in several modifications, as follows:

A B R A C A D A B R A	abracadabra	ABRACADABRA
A B R A C A D A B R	abracadabr	BRACADABR
A B R A C A D A B	abracadab	RACADAB
A B R A C A D A	abracada	ACADA
A B R A C A D	abracad	CAD
A B R A C A	abraca	A
A B R A C	abrac	
A B R A	abra	
A B R	abr	
A B	ab	
A	a	

Kopp, in his *Geschichte der Chemie,* states that the power of this talisman is said to be due to the fact that the word is a repetition of the initial letters, in Roman equivalents, of Father, Son, and Holy Ghost, in Greek and Hebrew languages.

WITCHES AND WIZARDS

Witchcraft constitutes a phase of magic which deserves a lecture all to itself. Several kinds of bewitchment were recognized, *i. e.,* voluntary and involuntary, physical and psychical. The word "witch" may be used in either the masculine or feminine sense. It ordinarily signifies one of the female gender, the terms "wizard" and "warlock" being used in the male sense. The word "sorcerer" usually is used synonymously with witch.

Jan Ferguson, in a recently issued book, *The Philosophy of Witchcraft,* says that woman was the first historian, poet, dramatist, theologian, and witch. One of the earliest specific instances of a person referred to as a witch is where Saul, King of Israel, consults the one whom Biblical critics say should be called rather the "Woman of Endor." Some commentators believe her to have been a genuine sorceress, others have argued that she was a skilful intriguer who took advantage of the credulity of Saul. Some of the accounts of this episode use the Greek word "python" to describe this woman. In the New Testament this word means a sorcerer, particularly a ventriloquist. "A certain maid having a spirit of divination met us." Acts xvi, 16. In the original Greek the word translated as spirit of divination is "python." The word also means a soothsaying spirit or a demon in the classical antiquities. The oracle of Apollo at Delphi was a python.

Early Christianity gave the witch a permanent place in society, which led in later centuries to a tragical period of persecution. Ferguson says:

> "Where the Church denounced the witch with hatred the struggling schools of medicine treated her with a contempt that was sometimes hardly justified by the instability of their own researches. Against the ancient philosophy of witchcraft the Church struggled to maintain the spiritual values, and in her frantic zeal to put Heaven within the hail of man commenced the long subservience of eternal verities. Where other sciences advanced theology alone was static. Between the two forces of things proved and things revealed stood the witch with her eternal philosophy of delusion and hope. . . . As sickness was attributed to the presence of evil spirits, the witch expelled them by pagan incantations; the priest with equal enthusiasm routed them with Christian exorcism."

He also says:

> "This deliberate determination of Christianity to adopt the ancient formulas of witchcraft is obvious enough in extracts from the prescriptions of physicians,"

and gives the following example from the *Leech Book of Bald,* a tenth century Saxon herbal:

> "Against chills at all hours of the day write on a paper and bind with a cord on the neck of the patient in the evening, the following: 'In the name of our Lord, crucified under Pontius Pilate, by the sign of the cross of Christ. Fevers or quotidian chills or tertian or quartan, depart from the servant of God. Seven hundred and fourteen thousands of angels will follow you, Eugenius, Stephanus, Protacius, Sambucius, Dionisius, Chesilius, and Quiriacus.' Write these names and let the patient carry them upon him."

In a work by Montague Summers, just published, entitled *The History of Witchcraft and Demonology,* the author includes under the heading of *Witchcraft:* Sorcery, Black Magic, Necromancy, Occult Divination, Satanism, and every kind of malign occult art. He shows the witch as an "evil liver; a social pest and parasite; the devotee of a loathly and obscene creed; an adept at poisoning, blackmail and other creeping crimes; a member of a powerful secret organization inimical to Church and State; a blasphemer in word and deed; swaying the villagers by terror and superstition; a charlatan

and a quack sometimes; a bawd; an abortionist; the dark counsellor of lewd court ladies and adulterous gallants; a minister to vice and inconceivable corruption; battening upon the filth and foulest passions of the age."

Witchcraft has played an important part in the world's history. At the time of the psychological epidemic in Europe, particularly during the sixteenth and seventeenth centuries, when witches were believed to be everywhere, not less than 100,000 were put to death, most of whom made "voluntary" confessions when subjected to torture. One single jurist, Benjamin Carpzov by name, is said to have sentenced 20,000 witches to death himself. The last execution of a witch took place in Scotland in 1722, in Spain in 1781, in Germany in 1793, and in Peru in 1888.

The Sabbat or Sabbath, also known as the Brocken Assembly, was a periodic gathering of witches who were believed to be transported thither upon the besom or broom. The word Sabbat is not derived from the same root word as the Sabbath, meaning the seventh day or day of rest. A coven was a group of witches. Walpurgisnacht was suposed to be the time of the annual festival of European witches in the Harz Mountains.

The belief in the evil eye is a modification of witchcraft and is also the "poltergeist" or jocular spirit who plays mischievous tricks instead of working injury. In Germany and in the German-settled districts of the United States a witch is called a "hexe."

A ghastly commentary on the uses to which witches' bodies were sometimes put is found in a recent catalogue of old manuscripts offered for sale by a European dealer. One of these is claimed to have been written on the specially prepared skin of a young woman executed for sorcery and whose body had been stolen from the gallows.

There are a number of miscellaneous terms used in connection with witchcraft in particular. The "larva" in Roman mythology was a ghost, a spectre or a shade. The "lamia" was an enchantress who enticed children for the purpose of feeding on their flesh or blood, and was practically the same as the vampire of later days, which was a mythical blood-sucking ghoul. The "lemures" were evil-disposed shades who did mischief to the living, particularly at night. They were exorcised annually, in medieval times, by the head of the household at midnight on May 9th, 11th or 13th. Milton says "The Lars and Lemures moan with midnight plaint."

The werewolf or lycanthrope was a human being who could assume the shape of a wolf for his or her nefarious purposes. The French call the werewolf a *loup garou*. The "concubitus," "incubus," or "succubus" are all terms that are fully defined and discussed in many works of reference. They are associated with dreams or nightmares.

The psychopomp was the guide or conductor of souls to the underworld, and Hermes was given this title by the Greeks. Metempsychosis is concerned with the changing of the souls or personalities of two human beings.

THE QUEST OF THE ALCHEMIST

Alchemy. The cult and practice of alchemy, which was a curious blend of abstract philosophy and laboratory experiments, has always been concerned with occult beliefs and practices, to a certain degree. The history and romance of alchemy have been repeatedly discussed and are available in the literature of pharmacy and chemistry. The Greek poet Theophrastos, whose work has been interestingly described by the eminent historian of chemistry, Dr. C. A. Browne, writes thus mystically concerning the philosopher's stone:

"Though not a stone, it yet is made a stone
From metal, having three hypostases,
For which the stone is prized and widely known;
Yet all the ignorant search everywhere
As though the prize were not close by at hand.
Deprived of honor yet the stone is found
To have within a sacred mystery,
A treasure hidden and yet free to all."

Theophrastos also eulogizes the altruistic aim of alchemy in the following lines:

"But most of all we wish with one accord
All mortals to be taught and disciplined
And trained in wisdom of the sophist school,
That they might shape themselves to perfect men,
That they might know the bounds of Nature's realm,
(How all things thrive and mix and interweave)
And last that they may nothing speak except
What words the wise old masters used to say.
These masters urge all mortals who are wise
To be instructed in the mystic lore
Of sacred rites, whose meaning they proclaim
By actions rather than by word of mouth."

One of the most interesting of philosophic articles upon the subject of alchemy is by Professor Arthur John Hopkins, who essays to prove:

1. That the fundamental art—the art that led up to alchemy—was the dyeing of fabrics, especially with Tyrian purple.
2. That by this fundamental art was absorbed the art of what we call bronzing, but what the Egyptian artisans called the tincturing or baptizing of metals.
3. That there was a close connection between these two decorative color processes.
4. That metals were identified by their original colors, but more surely by their bronzes.
5. That this last conception was upheld by Greek philosophy which was invoked in support of the newer engrafted alchemistic philosophy.
6. That the transmutation claimed and attained by the Egyptians was essentially a color transmutation, an artistic interpretation of laboratory experiments. To this transmutation was allied the transmigration of souls of the Egyptian religion.
7. That the conception of the philosopher's stone is in accord with this interpretation.

This entirely new theory of alchemy would divorce it entirely from occultism, but the actual practice as conducted by students and adepts in later centuries was much involved in mysticism.

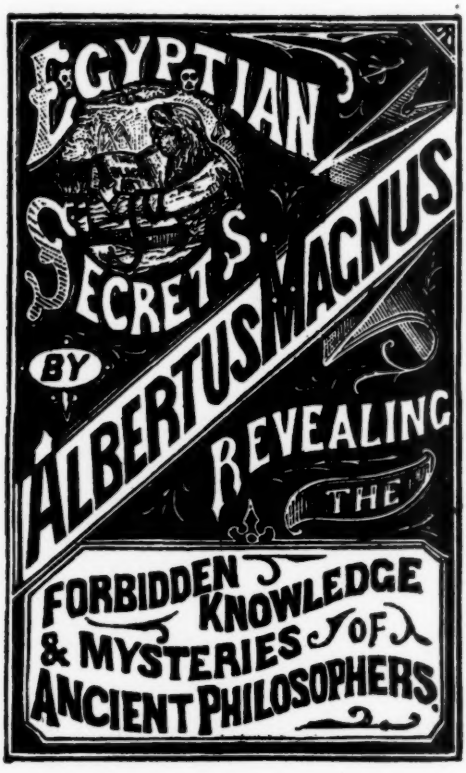
Mysticism. Mysticism is not necessarily a part of occultism, but many noted mystics have been credited with occult powers. The word "mystic" comes from a Greek root word meaning to be blindfolded and initiated. Its definition refers to anything obscure, mysterious, or incomprehensible.

There have been many sects of avowed mystics, among the most important of which are the Quietists, the Pietists, and the Gichtelians, which are described in general reference books.

The list of individuals who have been credited as being mystics are included in a separate library of works in which each volume is concerned with the life of a single individual. The names are as follows: Joan of Arc, J. B. Van Helmont, Raymond Lully, Zoroaster, Martin Luther, John Dee, Franz A. Mesmer, Saint Martin, Cornelius Agrippa, Joseph Glanvil, St. Francis of Assissi, Jacob Boehme, and Roger Bacon. This list might be extended indefinitely, but few would deny a place to Swedenborg, and the Cambridge Platonists are also entitled to consideration.

Cabalism or *Khabbalism* is a mysterious traditional Hebrew doctrine. It is the theosophy or philosophy of the Hebrew religion which became prominent in the tenth century. The term is used also in a generic sense to describe occultism in general or any secret science.

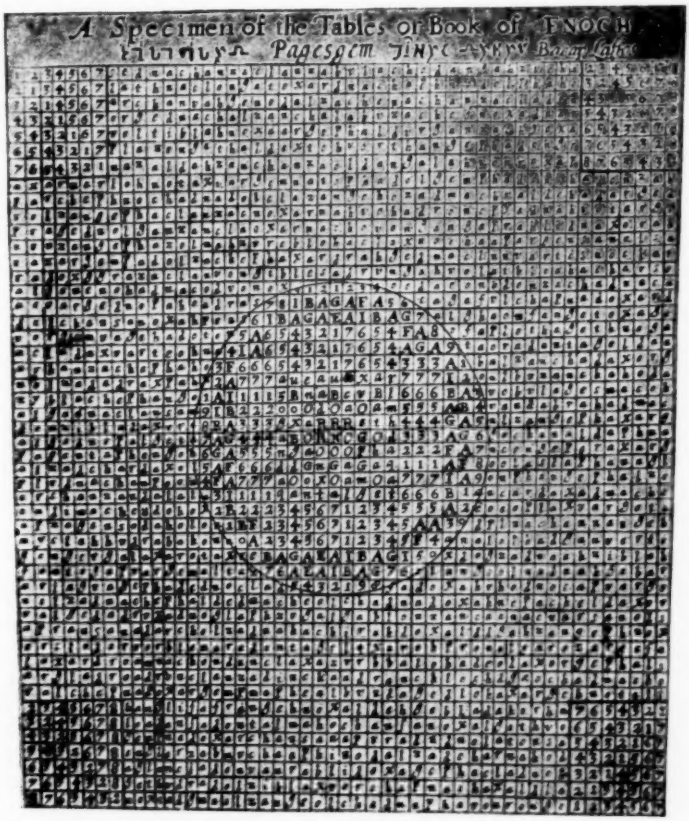
CABALISM



Title Page of a Modern Book Upon Occult Subjects

Several manuscripts have played a part of the development of the Cabala. One of these is attributed to Enoch, seventh lord of the earth after Adam, the Enoch who "walked with God and was not." One treatise which is concerned with fifteen stars, fifteen herbs and fifteen stones, upon each of which was engraved a figure. This manuscript is attributed by some authorities to Enoch, and by others to Hermes Trismegistus.

The Book of Enoch most prominently associated with the Cabala is a patchwork from several originally independent books which have come to us in fragments of Greek, Ethiopic, and Slavonic manuscripts. In this book are mentioned the fallen angels who took unto themselves wives from the daughters of men, following which they instructed the human race in the art of magic and the science



Example of a Page from the Book of Enoch, a Noted Work on Occultism

of botany. Pharmacy, astrology, geomancy, and aeromancy are also mentioned in this book.

A book attributed to Cadmus, the reputed originator of the alphabet, who founded the sacred city of Thebes, also figures in the original Cabala. In the Cabala the occult principle is called "the

Ancient." It is a mystery of signs and correspondences in which there are thirty-two paths and fifty gates. The thirty-two paths are based upon the ten arithmetical numbers and the twenty-two letters of the Hebrew alphabet. The fifty gates embrace all possible branches of human knowledge. According to the initiates of the Cabala, "the word" or human speech constitutes the revelation and the signs are sought in the letters which constitute the primitive alphabet.

The letter which is supposed to be the mother letter and to have generated all other letters is the Jod. The divine tetragram the Jod, He, Vau, and He (reading from right to left) is an important factor in the interpretation of the Cabala. This tetragram is occasionally used as a symbolic decoration at the top of the title page of medieval scientific works. The first edition of the *Pharmacopœia Londinensis,* 1618, is distinguished by the use of this word in a representation of a cloud at the top of the title page.

The Cabalists have also evolved the sephiric scale of the decade in which divine names and numbers are arranged in a triangle which when rendered into Roman letters is as follows:

J
J A
S D I
J E H V
E L O I M
S A B A O T
A R A R I T A
E L V E D A Å T
E L I M G I B O R
E L I M S A B A O T

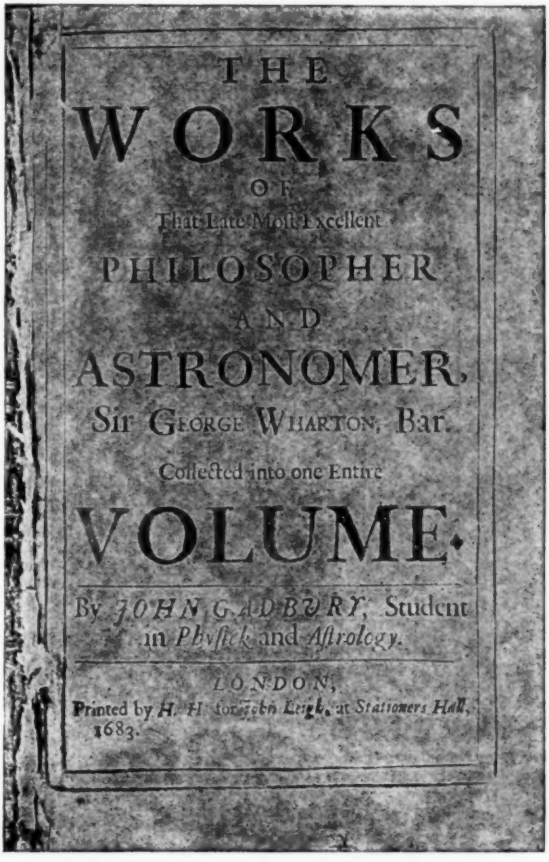
The Apocalypse or Revelation of St. John is said to contain, in concealed form, the cabalistic secrets of Christianity.

The absolute Cabala is the knowledge of the divine names formed from the tetragrammaton.

The name of Jehovah is divided into seventy explanatory names which are called "Schemhamphoras," or the name explained. The art of explaining these names and finding therein the keys of universal science is called the *claviculæ* of Solomon. The traditions of magic declare that the possessor of the clavicules of Solomon can converse with all orders of spirits and has power over all natural forces.

Astrology. Astrology, alchemy, and perpetual motion were banished for a time to the limbo of discredited quests. Alchemy has come back in a modern form in connection with the newer atomic theories. Astrology, which had never quite disappeared, is now reinstated in polite society through the medium of what we are pleased to call the newspaper. It

READING THE STARS


THE
WORKS
OF
That Late Most Excellent
PHILOSOPHER
AND
ASTRONOMER,
Sir GEORGE WHARTON, Bar.
Collected into one Entire
VOLUME.
By JOHN GADBURY, Student
in *Physick* and *Astrology*.
LONDON,
Printed by H. H. for John Leigh, at Stationers Hall.
1683.

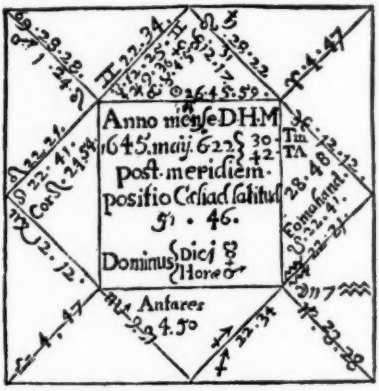
Title Page of Astrological Work of the 17th Century

had its origin in that cradle of civilization known as Mesopotamia. It developed coincidently with astronomy and rose to the dignity of a quasiscience at one time, and in medieval times the court astrologer

was just as necessary as the court jester, and just as reliable, if the truth were known.

Charles the Wise (?), who reigned in France in the fourteenth century, had firm faith in astrology and had a court astrologer whose sworn duty was to tell the King what was going to happen so that the King might take measures to prevent it from happening. What an opportunity for a clever individual! With the exercise of a little ambiguity in prophecies the astrologer stood to win every time, for if he foretold disaster and it came, fate was inexorable; if it did not come, it must have been averted by the measures which his royal master put into effect by reason of his timely warning.

A Cœleſtial Scheme, or Figure, ſetting forth exactly the true poſition and ſtate of the Heavens at the time His Majeſty began his March.



Fortitudes and Debilities of the Planets, according to their Scituation in the Figure.

Saturns Fortitudes by reaſon of his		Oriental	2
		Free from Combuſt.	5
Being in his term	2		17
In the 9 Houſe	2	Weak by reaſon of h's	
Direct	4	fall,	4
Swift	2		

P 3 *Jupiters*

Example of a Horoscope from an Old Astrological Work

Rudolph of Bohemia, the sixteenth century collector of fakers and charlatans, had faith in astrology, but unfortunately for him and fortunately for the world, the astrologers whom he selected, Tycho Brahe and John Kepler, turned out to be two world-famous astrono-

mers. Both of these men are said to have cast horoscopes as a side line. A graphic representation of a horoscope looks like a geometrical theorem gone cuckoo.

The most celebrated astrologer of all time, without a doubt, was Michel de Notre Dame, more generally known by his Latinized name, Nostradamus. He has been called the King of Astrologers. Like other astrologers he made many prophecies and like them they were couched in such enigmatic terms that their meaning was not quite clear until after their fulfillment. The prophecies of Nostradamus are said to extend to the year 3797 A. D. It would be interesting for someone to search through his works and see what he had to say of world history during the period from 1914 to 1918.

It was in this medieval astrological period that the signs of the zodiac came to be associated with the external and internal environment of man as illustrated in the almanacs. According to the astrologers the sign under which one was born makes a lot of difference in his or her career. It helps a lot to explain where the "poor fish" originate, and why some people are "crabs" and others "throw the bull." Why should we call ourselves civilized when modern newspapers carry paid astrologers on their staffs to interpret planetary influences for their readers, and radiobroadcasting stations answer letters and questions through the power of a medium with a crystal ball?

ROSICRUCIANISM

Rosicrucianism is one of the great mysteries among secret doctrines. The Rosicrucians have been linked with the alchemists, with the Freemasons, and with the powers of darkness. Heckethorn in *Secret Societies of All Ages and Countries* says:

> "A halo of poetic splendor surrounds the Order of the Rosicrucians; the magic lights of fancy play around their graceful day dreams; while the mystery in which they shrouded themselves lends additional attraction to their history. But their brilliancy was that of a meteor. It just flashed across the realms of imagination and intellect, and vanished forever; not, however, without leaving behind some permanent and lovely traces of its hasty passage. . . . Poetry and romance are deeply indebted to the Rosicrucians for many a fancy creation. The literature of every European country contains hundreds of pleasing fictions whose machinery has been borrowed from their pleasing system of philosophy, though that itself has passed away."

The literature pertaining to the Rosicrucians is a bewildering mass of contradictions and inconsistencies. Several histories of the order have been written in recent years, but these are diametrically in opposition to each other in many points. Even the origin of the name is in doubt. The first and most obvious derivation is the one which attributes it to the alleged founder of the order, Christian Rosenkreuz. The second theory is that it is derived from the Latin *Ros,* dew, and *Crux,* cross. The argument in favor of this latter view is represented by the following quotation:

> "Of all natural bodies, dew was deemed the most powerful dissolvent of gold; and the cross in chemical language was equivalent to light, because the figure of a cross exhibits at the same time the three letters of which the word lux, meaning light, is compounded."

The third derivation deduces the term from *Rosa,* rose, and *crux,* cross. This is upheld by authoritative documents of the Society in which the members are called *Fratres Rosatæ Crucis.* An early document concerning this strange and mysterious society was published anonymously in Strasbourg in 1616, and was called *The Chemical Nuptials of Christian Rosenkreuz* (*Chymische Hochzeit, Christiani Rosenkreuz*).

It may be that the rose was adopted as the emblem of silence or secrecy, a symbolism which first appeared in Germany where the rose was portrayed on the ceiling of the banquet hall or council chamber to warn the guests or members against the repetition of what was heard beneath it. Among the Romans the white rose was especially dedicated to silence, and our expression "sub rosa" was an inviolable pledge to a Roman.

The Crux ansata (♀), which dates from Egyptian times, is a hierogram in which are combined the outlines of the cross and the rose, according to some authorities, and there is no doubt that this symbol possessed an arcane meaning in Rosicrucian literature.

We must not attach too much importance to symbolism and its inferential interpretations. Martin Luther, the reformer, had as a symbol a cross-crowned heart rising from the centre of an open rose, but no one has associated his name with Rosicrucianism.

The earliest document dealing with the Rosicrucians was called *Confessio Fraternitates R. C.,* which appeared in 1615. The full title of this work was "The Fame of the Fraternity of the Meritorius

Order of the Rosy Cross," and it was addressed to the rulers of Europe. These mystical documents are not only difficult to interpret on account of their allegorical form, but contain strange symbols or characters which have not been deciphered. Was there really at any time a genuine secret fraternity of Rosicrucians, such as is described in Bulwer's interesting story of the occult, *Zanoni?* Bulwer probably received the inspiration for this tale from Eliphas Levi, with whom he was acquainted. If there was such an order, what was its real history? What powers did its members possess, and what has become of it? The accounts of the organization are enveloped in a mysterious halo of uncertainty. The accidental discovery of a secret sepulchre in the shape of a septagonal underground vault illuminated by a perpetual light, a limited number of members whose occult powers are unlimited, but whose idealism and purity of purpose restrain them from the improper use of such powers—these almost melodramatic factors have invested the name Rosicrucianism with a glamour and a fascination which is well nigh irresistible. The lack of definite knowledge may be argued as a point in favor of the reality of such an order. We shall leave the question open.

Divination in General. A book of comparatively recent origin upon the subject of magic has the following paragraph in the introduction to divination:

DIVINATION

> "The circle of each of the physical sciences is surrounded with a fringe of light, easy and pleasing experiments which in themselves are exceedingly trivial, but are as so many thresholds of the deep things of knowledge, and are to be valued for that which they lead to, and not for what they are. The profundities of esoteric science have also their light fantastic borderland where the tyro may amuse himself, and where the vacuous interest of the modern *dame de societé,* who describes herself as 'very occult,' finds sufficient nourishment to sustain a shallow and sentimental interest in the mysteries of psychic force. . . . Considerable futility is mixed up with divination; it is essentially trivial in character; in itself it can be productive of no valuable results; the student of discrimination and sense will not squander his time and his powers on the little marvels of magic art; he will win entrance into the larger field of achievement."

The word divination is occasionally used in a broad, philosophical sense which places a different complexion upon it. Its significance is extended till it includes the sublime dream of astrology, spiritual visions, and the gift of inspired prophecy. According to the

vulgar meaning of the term, to divine is to conjecture what we do not know, says Levi, but its true significance is ineffable in its sublimity.

Let us take these up in alphabetical arrangement and consider them concisely, for there is a long list of them.

Aeromancy. This is the art of divination by means of phenomena of the air. It is also called *meteoromancy.* The term is sometimes used to denote the practice of forecasting changes in the weather.

Alectoromancy or *Alectryomancy* is the art of divination by means of the cock or rooster. Chanticleer has always been credited with the ability to rout the hosts of darkness by his crow. In this form of forecasting the letters of the alphabet are traced upon the ground in squares within a circle, a grain of corn is placed upon each letter and a cock turned loose to feed. The order in which the letters are picked up are noted and the letters are then formed into words or used as initial letters of some portentous message.

Aleuromancy is a method of divination by meal or flour, practiced for many centuries. Letters, words, and phrases are written on strips or squares of parchment or paper and mixed with meal or flour, which is subsequently made into a dough. A portion of this unbaked dough is then taken and soaked in water, the paper strips removed, and the message interpreted.

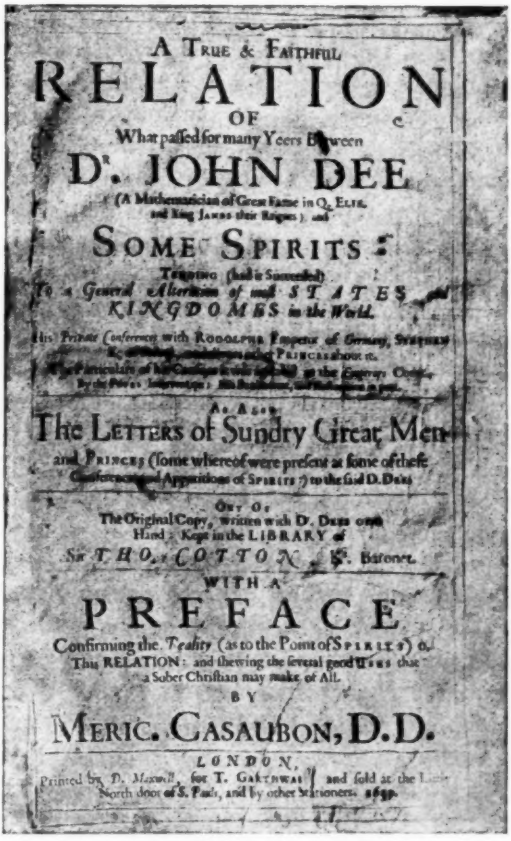
Alphitomancy is also a divination by means of meal. In this case barley meal was used. This was mixed with salt and milk without leaven, baked in the ashes of the hearth in a grease-soaked paper and finally removed and rubbed with vervain. This hard, concrete-like mass was then broken into fragments which were administered to those suspected of having committed a certain crime. Those who could swallow a lump of this material without any lubricating liquid were dismissed as guiltless. Those who choked or strangled or who were unable to swallow it were adjudged guilty.

Amniomancy was a form of divination practiced by the Greeks with the caul of a new-born child. Omens were drawn from the texture and color of the membrane.

Anthropomancy was a gruesome form of prophecy based upon the examination of the entrails of a sacrificed human being. This practice is of extreme antiquity and was mentioned by Herodotus.

Arithomancy or *Arithmancy* depends for its efficacy upon the mystical properties of numbers. It is known as the science of esoteric mathematics and also dates from a very early period. The *Chaldean*

Oracles of Zoroaster is an ancient work on that subject. Even today many people have what they call "lucky numbers." The only real lucky number of modern times is the telephone number that you get correctly the first time.


A True & Faithful
RELATION
OF
What passed for many Yeers Between
D^r. JOHN DEE
(A Mathematician of Great Fame in Q. Eliz. and King James their Reigns) and
SOME SPIRITS:
To a General Alteration of most STATES and KINGDOMES in the World.
As Also
The LETTERS of Sundry Great Men and PRINCES (some whereof were present at some of these Conferences and Apparitions of SPIRITS) to the said D. Dee.
Out Of
The Original Copy, written with D. Dees own Hand: Kept in the LIBRARY of
Sr THO. COTTON, Bt. Baronet.
WITH A
PREFACE
Confirming the Reality (as to the Point of SPIRITS) of This RELATION: and shewing the several good Uses that a Sober Christian may make of All.
BY
MERIC. CASAUBON, D.D.
LONDON,
Printed by D. Maxwell, for T. Garthwait; and sold at the North door of S. Paul, and by other Stationers. 1659.

Title Page of Work by John Dee, the Famous English Alchemist and Occultist

Astragalomancy. This is a form of divination by means of a pair of dice which may be cast singly or in doubles. Alphabetical characters are arbitrarily assigned to the numbers and the results of a number of casts interpreted as in other forms of divination when letters are selected.

Axinomancy is an ancient kind of divination for the detection of crime, in which an axe is used. There were several methods of applying this method, all of which were equally unreliable.

Belomancy. An ancient form of divination by arrows or darts, practiced by the Babylonians, Scythans, Arabians, and other ancient peoples.

Bibliomancy, also called *Sortes Biblicæ* or *Sortiariæ.* Several forms of divination were practiced with the Bible. In one of these the book was opened with a golden pin and an omen was drawn from the first passage which presented itself. This method plays an important part in Tennyson's poem of Enoch Arden. In another form a large Bible was placed on one side of an old-fashioned balance. The person suspected of crime or of black magic was placed on the other side. If he outweighed the Bible he was innocent; if not, he was guilty.

Capnomancy. This was a form of divination by means of smoke or vapor. In one form certain seeds and drugs were cast upon a fire and the form assumed by the smoke wreaths interpreted. In the other the operator inhaled the smoke and was inspired thereby with the gift of prophecy.

Cartomancy is the form of fortune telling or divination by means of playing cards, and is too well known to require description.

Cephalonomancy. Lighted coals were placed upon the head of a donkey. Prayers were recited, and the names of suspected persons mentioned at random. The one whose name was mentioned at the moment when the ass brayed with pain, was adjudged guilty.

Dactyliomancy. This is divination by means of a finger ring. It was much used in olden times and played an important part in the trial of the conspirators Patricius and Hilarius in connection with the successor to Emperor Valens. There are certain rings known as constellated rings, which require much ceremonial in connection with their use.

Gastromancy. This is literally "divination from the belly," and is usually applied to ventriloquism, although belly-shaped glasses filled with water have also been used in a manner similar to that of the crystal ball.

Geomancy. This is divination by means of the earth. Geographical position, configuration or even the use of earth or dust itself are variant forms of this variety of divination.

Gyromancy. This is practiced by a person walking in a circle until he falls from dizziness, the direction of the fall being significant.

Hippomancy. This is based upon the use of white horses. (Perhaps the old notion that every time one saw a red-headed girl a white horse would be visible was based on this same superstition.) This was originally a Celtic rite, and the sacred horses were kept in consecrated forests and fed at the public expense.

Hydromancy. This is a branch of clairvoyance in which water is used in various ways as the divining medium.

Ichthyomancy is a form in which an inspection of fish entrails affords the necessary data for prognostication.

Lampodomancy involves the inspection of the flickering flame of a lamp; not an electric lamp, however.

Lithomancy is divination by stones. Certain semi-precious stones, such as the amethyst, were especially gifted as media for this purpose. It is not generally known that the word amethyst is derived from sources indicating its protective power against the effect of wine.

Margaritomancy requires pearls for its consummation.

Myomancy. In this form of divination mice are employed. It is probably one of the most ancient forms, for in the Old Testament Isaiah classes mice among the abominable things of the idolators.

Onomancy or *Onomatomancy* is the use of names in predicting future happenings. This form is often used by school boys and girls for the purpose of determining the feelings of one of the opposite sex.

Onychomancy. This is not as trivial as one might suppose, and the method is distinguished by being associated with the power of the angel Uriel. Upon the nails of the right hand of a young boy or young girl is placed some fixed oil or wax and some pigment, such as blacking. The anointed nails are turned toward the sun and observed by the seer, who was required to face the east for some kinds of divinations, while in other cases the seer must face the south or the west.

Oömancy requires the use of eggs. It is usually practiced by opening an egg into a glass of water and observing the form which it assumes.

Parthenomancy. This was a form of divination in which a virgin or young girl was employed.

Pyromancy is another very ancient form in which flame or fire affords the needed factor for occult judgment.

Rhabdomancy, also called *Bletonism* or *Dousing,* is the use of the forked witch hazel branch, commonly called the divining rod, which is employed, even today, in locating subterranean streams of water or for finding hidden treasure or valuable mineral deposits.

Sciamancy is really a form of necromancy or evocation of the shades of the dead, which has already been considered.

Spodanomancy or *Spodomancy* is divination by means of ashes scattered in an open place and written upon by the use of a finger. After exposure over night any letters that remain legible, of the question that has been written, are utilized in the interpretation of the answer to the question.

Sycomancy must have been the earliest form of divination, for fig leaves are employed as the oracles.

Theomancy is a form of cabalism and is concerned with the use of sacred names.

A conjuror is etymologically one who is bound by an oath, literally, a conspirator. The common use of the term places the conjuror in the same class as the enchanter or the magician. The conjuror also is grouped with the class of diviners, or those who foretell the future by various means. An augur is literally a bird conjuror, from *avis,* bird, and *gur,* a chatterer. The augur was an important functionary and official in the days of the Roman Empire. There were sixteen of them in the time of Julius Caesar. They wore togas with broad purple borders and each carried a rod called a *lituus,* and was accompanied by the sacred bird. The haruspex was another soothsayer of Roman times who exercised his art by the inspection of entrails.

The golem was an artificial human being, specially constructed and later endowed with life. The golem plays a part in Hebrew ocultism, and often turned out to be a sort of Frankenstein.

In this very complete list, comprising nearly two-score forms of divination, no mention has been made of the use of tea leaves or coffee grounds, both of which practices, while possessing great popularity, seem not to have found their way into the formal literature of the subject.

The Ouija Board or planchette must not be overlooked in the consideration of popular forms of divination. "Ouija" is a trade name for the device known as planchette (literally a small board), and means to answer "yes." It is a heart-shaped or triangular board mounted on three supports, of which two are easily moving coasters

or wheels, and the third is a pointer or pencil point. The original planchette traces letters or sentences by subconscious movements of the operator and thus answers questions or transmits messages. The Ouija Board is provided with letters and numerals and the subconscious movements of the operator cause the spelling out, letter by letter, of answers and messages.

Ordeal by poison is a primitive form of sorcery in which the guilt or innocence of a suspected person is determined by the administration of a poisonous potion. If the suspect recovers, he or she is innocent; if death ensues, the suspected person is guilty. Calabar bean, a poisonous seed containing a valuable principle known as eserine or physostigmine, much used by ophthalmologists, was originally used by certain African tribes as an ordeal substance, and the synonym "ordeal bean" is still applied to it.

Other forms of ordeal are known. In Burma, suits between natives are still determined by the plaintiff and defendant each being furnished with a candle. These are equal in size and weight and both are lighted simultaneously. The one whose candle burns the longest is adjudged the victor in the suit. This method might be used by the United States Senate to determine the eligibility of rival contestants, with great economy of public funds and almost equal certainty of justice, as compared with present procedures.

The *Encyclopedia Britannica* contains a comprehensive article upon the subject of ordeals, in which many other methods are described.

PALMISTRY, PHRENOLOGY PHYSIOGNOMY

Palmistry, which is sometimes called Chiromancy or Chirognomy, is divination by the lines and lineaments of the hand. One who practices this art is called a "chirosophist."

Phrenology, or the evaluation of the faculties of the individual by study of the shape of the head, originated much later than most other forms of divination, as it first appeared toward the close of the eighteenth century. The system was founded by Dr. Franz Joseph Gall, a Viennese physician, and was extended and promulgated by his pupil and associate, Dr. Spurzheim, to whom we owe the phrenological charts and faculties so frequently seen. Phrenologists often advertise their accomplishments with the slogan, "We can read your head like a book." Modern anatomy, physiology, and psychology have refuted the extravagant claims of phrenologists.

Physiognomy, which is sometimes called Metoposcopy, is a form of divination kindred to phrenology, in which the character and disposition of the individual is discovered by a study of the features and lines of the face. This is not infallible as a guide to character. There are photographs in the Rogue's Gallery of individuals who look like anything but the criminals which they are.

We could ramble on indefinitely, finding new evidences of human superstition and credulity on every hand, but we have gone far enough to show the widespread extent to which occultism has developed. Dr. David Starr Jordan coined a word more than twenty-five years ago which, while it has not found its way into general literature, certainly fills a need in connection with a discussion of this kind. It is the word "sciosophy," and means "systematized ignorance."

Giordano Bruno, the Florentine scientist who was burned alive by the ecclesiastic sciophists of his time, said of ignorance: "It is the most delightful science in the world because it is acquired without labor or pains and keeps the mind from melancholy."

Do not think for a moment that all of these occult practices are of the past. "Powwowing" is still practiced in some parts of Pennsylvania, and witchcraft is by no means a despised or neglected art. The dream book still has its votaries. Publishing houses still issue books giving dogmatic and detailed directions for becoming an adept in various branches of occultism. Much of the patronage of these false leaders comes from the credulous among the uneducated, but even among the so-called "intelligentsia" are found victims of these delusions, reminding us of an old Arab proverb which says: "When the learned man errs, he errs with a learned error."

In conclusion let me say in the words of one of our popular cartoonists, "Most of it's the bunk."

MALTED MILK

By Edward S. Rose

PROBABLY every man, woman and child in the United States has at least heard of the food product Malted Milk. One might imagine it to be true if he considers that this product is probably served at every soda fountain, sold in every drug store, and in many grocery and department stores and by mail-order houses the country over.

Some credit Von Liebig as the first to prepare a dry form of milk and malt extract. Others claim that William Horlick, Racine, Wisconsin, in 1883, originated the process of making in a dried form of whole milk and the soluble extracts of malted grain which would keep indefinitely. It is not the purpose of this paper to prove the origin of this valuable food product. Malted milk is not a trademarked name nor is its process of manufacture patented. Most of the malted milk in the United States is manufactured by four large companies.

Very little is found in the literature concerning this product. The Microanalyses of Malted Milk by Ballard (*J. A., Ph. A.*, 7, 1918, p. 326) is an interesting paper, dealing mainly with micro-analytical methods of detecting standard and mixed products. Wheeler and Biester (*American Jour. Diseases of Children*, 1914) give results of feeding certain brands of malted milk to white mice. Brief references may be found in some textbooks and journals but the writer has not found any extensive paper dealing with this product.

Purpose

The purpose of this paper is to discuss malted milk from several angles as consumption, composition, food value, the writer's experimental work on its production, suggested equipment for its manufacture, and cost of production.

Consumption

It would probably be difficult to obtain complete statistics as to the amount of malted milk consumed. The Year-Book of the Department of Agriculture gives the amounts of malted milk manufac-

tured in the United States for the five years (1920-1924, inclusive) as follows:

1920	19.7	million	pounds
1921	15.7	"	"
1922	13.7	"	"
1923	15.3	"	"
1924	15.9	"	"

These statistics are obtained by the Bureau of Animal Industry from reports and investigations. It would also be difficult to determine what amount of malted milk is consumed at soda fountains and that sold in packages. It is the writer's opinion that much the larger part is used by soda fountains, which usually buy a special brand in twenty-five-pound tins. In the stores malted milk is sold in one-half, one, and five-pound glass containers.

Composition

The usual statements of composition on packages of malted milk claim they are mixtures of the extract of malted grains and rich milk reduced in vacuo to a solid and subsequently powdered. Food Inspection Decision No. 170 says:

> "Malted milk is the product made by combining whole milk with the liquid separated from a mash of ground barley malt and wheat flour with or without the addition of sodium chloride, sodium bicarbonate and potassium bicarbonate in such a manner as to secure the full enzymic action of the malt extract and by removing the water. The resulting product contains not less than seven and one-half per cent. of butter fat and not more than three and one-half per cent. moisture."

The extract from the grain is mainly maltose and dextrin with smaller amounts of dextrose, fat and protein substances. The solids of milk are lactose, casein (and smaller amounts of other protein substances), fat and salts. Any enzymes in the milk and malt are probably not found in the malted milk. Vitamins of the raw materials may or my not be present in the finished product, which is discussed later on. So malted milk consists mainly of soluble carbohydrates with smaller amounts of protein substances, fat, salts and water.

Analyses of malted milk may be found in the literature of the manufacturers and in some text and reference books. A typical analysis given by Hutchinson in *Food and Principles of Dietetics* is as follows, stated in per cent.:

Fat	*Protein*	*Soluble Carbohydrates*	*Mineral Matter*	*Water*
9	13.8	70.8	2.7	3.7

In the above analysis if full cream milk, say 3½ per cent. butter fat were used, which would have approximately the following percentage composition in powdered form (Fat 27.7, Lactose 35.6, Protein 27.7, Ash 6, and Water 3), and if calculating from the fat content, it would indicate that 32.5 per cent. of the malted milk in question were powdered milk. On the basis of the protein content, allowing about 1 per cent. as coming from the malt extract, it would indicate 46.2 per cent. milk powder in the malted milk, which in turn would indicate that the milk used was about 2 per cent. butter fat. In the latter deduction it is assumed that practically all of the gluten, which is of a protein nature, was removed from the extract of the malted grains since in the writer's opinion its presence in a malted milk is objectionable. It may be seen from these deductions that it is difficult to arrive at a satisfactory conclusion as to the amount of milk solids present.

The writer analyzed three brands of malted milk to ascertain whether the products sold in the stores differed from those served at fountains. Fat was determined by a modified Werner Schmid method (*Amer. J. Phar.* 98, 1926, p. 595); protein was found by the Gunning-Kjeldahl method, using 2-3 gm. of sample; ash was determined by ignition of 1 gm. to constant weight; water was found by drying 2 gm. on a petri dish at 100° C. to constant weight; carbohydrates was found by difference. The results are:

Brand	*Fat*	*Protein*	*Carbon-hydrates*	*Ash*	*Water*
Store	8.31	14.69	69.95	3.90	3.34
Fountain	8.07	14.37	70.91	3.88	2.86
Fountain	7.35	13.53	72.59	3.12	3.76

In the above analyses it is noted there is some difference in composition. One fountain sample is below standard in respect to fat content and moisture.

Food Value

In general the statement on a package of malted milk or in accompanying literature says it is a well-balanced food, highly nutritious and beneficial for both young and old in wasting diseases, fevers and digestive disturbances. A valuable food for nursing mothers, the aged, invalids, and convalescents. It is a reliable food for infants.

Malted milk is a food of high caloric value. Calculating from the analysis by Hutchinson, with the accepted equivalents per gram for protein, fat and carbohydrates, namely, 4, 9, 4 (*Bulletin* 28, *Office of Experiment Station,* U. S. Department of Agriculture), 100 gm. malted milk equals 419.4 calories. Some of the common foods with the amount of calories per 100 gm. are as follows: White or graham bread, 263; cheese, American, pale, 435; cocoa, 500; eggs, uncooked, 147; fowls, 222; halibut steak, 120; lean beef meat, 345; macaroni, 357; whole milk, 69; whole milk, dried, 518; oranges, 51; peanuts, 555; white potatoes, raw, 83; prunes, dried, 303, and cane sugar, 400. Compared with these common foods malted milk shows a high food value as regards heat units, but its cost is greater. However, malted milk is somewhat of a balanced food and will sustain life normally in adults while most of the common foods mentioned will not if used alone.

A popular drink at soda fountains is known as "Malted Milk." This drink is mixed in many different ways. A typical mixture for a plain malted milk is as follows, with approximate caloric value:

Malted Milk, three spoonfuls (about one ounce)...	121	calories
Syrup, 1-1½ fluid ounces.....	128	"
Ice cream, one dipper (12 to the quart)....	104	"
Milk, whole, enough to make 12 ounces.....	163	"

From the above it is noted that a glass of Malted Milk has a fuel value of approximately 516 calories with only 121 coming from the malted milk itself.

Is malted milk a reliable food for infants? Very little is found in the literature concerning this question. Wiley says in 1001 tests that malted milk is an excellent and nutritious food for adults but not suitable for infant feeding in general.

Manufacturers say malted milk is a reliable infant food. If it is reliable it should contain those constituents (vitamines) that promote healthy growth and prevent deficiency diseases as scurvy, rick-

ets, etc. The raw materials, that is, milk, wheat and barley, contain these vitamines, which, however, may be destroyed by high temperatures and oxidation in the course of manufacture.

Investigators, working on the production of powdered milk, disagree as to the best way of preserving these constituents. In general there are two methods used, namely, the Spray and Drum or Roller. Hess and Unger (*J. Biol. Chem.* **38**, *293,* 1919) say that powdered milk dried according to the Just-Hatmaker process (Drum or Roller) for a few seconds at 116° C. will protect against scurvy as well as fresh milk. Hart, Steinbach and Ellis (*J. Biol. Chem.* **46**, *309-318,* 1921) claim that the Spray process destroys the antiscorbutic properties of the milk, but the Just process preserves these properties. Cavanaugh, Dutcher and Hall (*J. Ind. Eng. Chem.* **16**, *1070-73,* 1924) find the Spray process of producing powdered dry milk to be highly satisfactory and does not destroy the vitamines. The particular process the manufacturer of malted milk uses is secret, but probably it is one or the other of the two mentioned above.

Very little data is found in the literature on the feeding of malted milk to experimental animals. Wheeler and Biester in their work on white mice, used a basal diet free of vitamins to which was added proprietary foods, two of which were of the malted milk type. These two foods, and especially one of them, appeared satisfactory in maintaining normal health and growth as far as the third generation when the experiments were closed. These investigators conclude that these two are perfect foods at least for white mice. Unfortunately this work was carried out on mice. Funk classes mice with rats as regards vitamin requirements. McCollum has shown that rats do not need antiscorbutic protection for they are able to synthesize their own protection. If this is true then this work on white mice does not prove the presence of antiscorbutic properties in malted milk. The guinea pig would have been the better animal to use.

Whole milk contains vitamins A, B, C and D, while wheat and barley probably contain all but C, if so, and if the milk solids in the malted milk is 40-50 per cent., and further assuming the vitamins are not destroyed in the process of manufacture, would there be sufficient vitamin C to prevent scurvy? Many experts in infant feeding insist on the addition of some vitamin-bearing substance even to whole raw milk since it cannot be absolutely depended upon, for the vitamin content may vary due to the season of the year and food of the cow. Whether malted milk contains the necessary vitamins and

in sufficient quantities to promote normal growth in infants seems somewhat uncertain as based upon published data. McCollum reviewing the claims made by investigators in the drying of milk powder says: "The only safe attitude toward the use of dried milks in infant feeding is to insist upon the addition of some effective anti-scorbutic food such as orange juice, tomato juice, swede juice, etc."

Experimental Work

A few years ago the writer carried out considerable experimental work on making malted milk. In general the procedure was as follows: Ground wheat and barley malt in different proportions up to equal parts were macerated in water for an hour. This mixture was then heated for 10-30 minutes at temperatures ranging from 45-75° C., then allowed to stand and the supernatent liquid drawn off. The residue was strained and the liquid added to the other. Small amounts of salt, sodium or potassium bicarbonate (or hydroxide) and pasteurized milk, from which the cream had been removed, were added to the liquid extract. The amount of milk taken was enough to make the milk solids equal about 40 per cent. in the dried product. This mixture was concentrated to about 40 per cent. solids in a vacuum pan at a temperature around 45° C. Enough cream was added to this concentrate to make the original milk 3½ per cent. butter fat. Then this mixture was placed in a pan and the water removed in a vacuum shelf dryer at about 60° C. and a vacuum of 26-27 inches. The resulting solid was scraped from the pan and powdered in a mortar. About ½-1 per cent. sodium bicarbonate was added and mixed well. This mixture was then bottled and sealed.

Suggested Equipment for Its Manufacture

The following equipment suggest themselves as necessary for manufacturing malted milk: Mill for grinding the grain; digesters or kettles with adjustators for preparing the extract; a filter press or other means for pressing the residue of mash after drawing off the supernatant liquid; vacuum pans with adjustators and necessary equipment for concentrating the liquids; a machine such as a vacuum drum dryer for reducing the concentrated liquid to a flake-like powder; a mill and bolting machine may be needed to obtain a fine powder; pasteurizing equipment for taking care of the milk; storage vats

and a refrigerating room; a pipe line and air pressure for conveying the liquids. Other equipment such as is needed in all manufacturing plants is not enumerated.

Cost of Production

It may appear presumptuous to give a cost for producing malted milk when not engaged in its manufacture, however, the writer would say that up to the time of placing the product in the container the cost would be 12-15 cents a pound. This estimate is based upon information furnished by firms who make the different equipment, the writer's experimental work and the cost of the materials. This cost would cover such items as the materials that enter into the malted milk, water for steam and cooling condensers, fuel, labor, oil waste, repairs, depreciation of 5-10 per cent. on machinery and boilers, etc. The manufacturer must add to this estimate the cost of the package, labor of packaging, advertising, selling, shipping, and overhead due to buildings and office.

Service Laboratory,
Iowa City, Iowa.

A PHARMACEUTICAL ASPECT OF CHINA IN 1927

By John Cameron, Ph. C., F. C. S.

Member of Pharmaceutical Society of Great Britain; Pharmacist, Peking Union Medical College, China

DURING our visit to the United States in 1925 we were not a little surprised to find so much interest in China and things Chinese amongst American pharmacists. It was our privilege to visit many pharmacies and drug stores in the States in cities so far removed as San Francisco and Boston. We visited most of the important wholesale chemical and pharmaceutical houses in the United States, and we would take this opportunity of thanking the various houses visited for their wonderful kindness and thoughtfulness to us while we were their guest. Especially amongst the wholesale pharmaceutical houses did we find a keen interest in China and all the possibilities of developing the China market pharmaceutically. It may be of interest to readers of the AMERICAN JOURNAL OF PHARMACY, if we briefly run over the present position of pharmacy and things pharmaceutical in

this country. At present (January, 1927) the eyes of the whole civilized world are directed towards China, and there are many columns in all the home newspapers devoted to the latest developments in the political situation in this country.

In a previous article [1] we discussed the various kinds of pharmacies and drug stores functioning in Peking. In our opinion the old-fashioned Chinese drug store keepers will never get together and form any kind of society or organization. Their chief interest in life is to compound all kinds of decoctions, supply raw herbs either whole or powdered, and make special pills. We have found that in the older of the typically Chinese drug stores the proprietor is usually a direct descendant of the founder of the business, and they have some specially prepared secret remedy—sometimes powder, sometimes plaster, sometimes pill, for which they are noted. They do not desire any union with other drug stores, but prefer to carry on their business alone, possibly because they fear that their own special products may somehow become common property. We have found it very difficult to get any real information about these old-fashioned drug stores. After exhaustive inquiries, however, we have discovered that they have some kind of combine which enables them to purchase their crude drugs more cheaply than they would if they purchased singly. One shop will be responsible for the purchasing of a certain root or bark, and when this arrives it will be distributed amongst the other members of the group. This system helps to keep prices down, because there is necessarily very little competition in the purchasing of crude drugs. But in our opinion we must look to the newer-styled pharmacies for any future we may wish for the science and art of pharmacy in China. It is interesting to see in all the larger cities of China, especially in the treaty ports and capital cities of the various provinces, how these modern pharmacies are making their appearance. Many of the proprietors have received their earlier training in some of the foreign pharmacies of the treaty ports. They have properly equipped dispensing departments and usually have a photographic department as a side line—but from our own observations in various parts of the country their chief business in pure pharmacy seems to be the issuing of patent medicines and tablets. In some Chinese pharmacies there are Chinese pharmacists in charge who have received their training in some of the pharmaceutical colleges of the United

[1] This Journal, pp. 665-671, October, 1925.

States; these pharmacies are, however, the exception. They are typically modern in every respect and they dispense all kinds of prescriptions in the usual run of business. In this connection it is interesting to note that in this institution we have the only Chinese in the world holding the major qualification of the Pharmaceutical Society of Great Britain.

Pharmacy in China, with the exceptions already noted, is therefore in the hands of unqualified men; by unqualified, we mean they have no officially recognized diploma or degree which certifies that they have undertaken a course of study at some school or college of pharmacy. They have learned all they know about pharmacy either in a foreign-owned or managed shop or they have perhaps received some of their earlier training in a mission hospital or institutional pharmacy. We know of some cases where no early training in pharmacy has been received—where some friends of the present owner have advanced sufficient capital to fit out the pharmacy in the hope that it may prove a profitable venture. The problem confronting pharmacy in China today is great. Each year sees increasing numbers of Chinese students, male and female, graduate in medicine from the various medical colleges of the country, while there are numbers of Chinese medical men returning from American and European universities to settle down in their own land. All these doctors will be writing prescriptions—the problem is, therefore, who will dispense these? Who at present can dispense them? Unfortunately, there only seems to be but one answer—the medical men themselves. During the past few months we have been consulted by quite a few young Chinese medical graduates as to where they can have their prescriptions accurately dispensed in China—outside foreign pharmacies. They all express doubts as to the ability of the present-day proprietors of pharmacies to dispense their prescriptions as written. We have heard of several cases where some common pharmacopœial preparation was ordered and it was for some reason impossible to supply it. On inquiry it was discovered that it had never been heard of in the pharmacy. What is being done in China today to teach pharmacy to the Chinese? We must confess that very little is actually being done anywhere in the country to teach practical and theoretical pharmacy. So far as we know, there is only one institution in China where pharmacy is a subject on the curriculum. This is at the Institute of Hospital Technology, in Anking, where our good friend Dr. George Hadden has one or two classes of young men whom he is training to

become dispensers in charge of mission hospital pharmacies throughout China. These dispensers, however, are not what we in the United States are accustomed to regard as trained pharmacists. Dr. Hadden himself only plans to give these students a course in elementary pharmaceutical principles and practice which will the better fit them to run mission hospital pharmacies. It is interesting to note that they receive a short course in tablet making. But, unfortunately, very few of these students have even an elementary knowledge of chemistry or botany. In probably a dozen of the larger hospitals in China there are foreign pharmacists in charge of the pharmacy. In these pharmacies a limited number of students or assistants are trained. In some institutions such as our own there is a definite course in pharmacy which usually extends to a period of five years. In this time the student is trained in pharmacy, practical and theoretical. in chemistry inorganic and organic (elementary), in botany and pharmacognosy (elementary). At the end of five years they sit an examination set by external examiners in the various subjects, and if successful they are awarded a diploma which states their length of service in the institution and the subjects they have been examined in. This diploma is signed by their various examiners. Our accommodation is very limited and we can therefore only take a few students at one time. It is interesting to note that all our pharmacy students who have left during the past few years have found positions in mission hospitals throughout the country; in no case have they gone into retail pharmacy. The great need of China, pharmaceutically speaking, is an institution where a proper and systematic study of pharmacy and the allied subjects can be had. That many young Chinese are deeply interested in pharmacy and anxious to learn the subject is evident from the long list of applications usually to be found in all the larger hospital pharmacies throughout the country. We ourselves have had well over one hundred applications from young men in China whose homes were as far apart as Canton and Mukden.

The difficulty is that at present there is no college where these students may go. As we have suggested elsewhere,[2] now is the ideal time for some wealthy Chinese to come forward, build and equip a college where pharmacists may be trained properly in pharmacy and

[2] *China Medical Journal,* in press, January, 1927; *Indian and Eastern Druggist,* in press, January, 1927.

the allied subjects. It might also be found possible to add a study of pharmacy to the present curriculum of some of the universities and colleges where chemistry, physics and botany already figure on the list.

A Chinese Pharmacopœia

In China today we are wholly dependent on foreign pharmacopœias for the standards of purity of the various chemicals and drugs used in medicine. We depend chiefly upon the U. S. P., the B. P. and the Japanese Pharmacopœia. But what we need is an official Chinese Pharmacopœia. During the past ten years various suggestions have been made as to using one or other of the foreign pharmacopœias as the standard for China until such time as an official pharmacopœia can be decided upon for this country. But up till the present time nothing very definite has been done. Our suggestion would be to incorporate all that is best in the U. S. P. X and the 1914 B. P.—these volumes have much in common—and for the present make this work the standard for pharmaceutical products in this country.

Peking Pharmaceutical Society

In December, 1926, the above-mentioned society came into being. This is purely a Chinese organization and so far as we know is the first of its kind to be formed in this country. The officers of the society will be found on the enclosed letterhead. Meetings have been held on the second and fourth Wednesdays of each month, and some interesting papers have already been read on subjects of pharmaceutical interest. We may mention some of the subjects discussed.

1. Distillation, Pharmaceutical.
2. A Chinese Pharmacopœia.
3. Purchasing drugs in China. (With actual figures and facts.)
4. Preparing alkaloids on a commercial scale.
5. Experiences of a Chinese pharmacist in London.

A great deal of interest is being shown in these gatherings and much helpful discussion takes place. It has been suggested that at one of these monthly meetings only the Chinese language should be used, and in this way it is hoped that many Chinese pharmacists who do not speak English freely will be encouraged to attend and take part in the discussions. The president has very kindly offered to

analyze any doubtful chemicals which members of the society may have in their pharmacies. Advice is often asked and given as to methods of manufacture, pharmaceutical processes, etc.

It is to be hoped that similar organizations will be formed by the Chinese themselves in other cities. If this can be arranged it might yet be possible to form a Chinese Pharmaceutical Society which would eventually be able to control the practice of pharmacy in this country.

Wholesale Pharmacy

During September, 1926, there was a pharmaceutical exhibition held in this college, the occasion being the biennial convention of the China Medical Association. We were deeply interested in a stall at this exhibition which belonged to a Chinese wholesale pharmaceutical concern. They exhibited samples of tablets, pills, capsules, etc., which they themselves had manufactured in China and were competing with various well-known foreign drug houses (American and European) who have branch establishments in the Far East. This is certainly a new development in the pharmaceutical field of China and one which we trust will expand.

ABSTRACTED AND REPRINTED ARTICLES

THE DETECTION OF SMALL AMOUNTS OF FORMALDEHYDE*

IN A SERIES of articles in the *Pharmazeutische Zentralhalle* (1926, **67**, beginning page 289 of the issue of May 6, and continuing in the succeeding issues to June 17, inclusive) Th. Sabalitschka and Clotilde Harnisch report a comprehensive study of the tests suggested for the detection of formaldehyde with regard to delicacy and certainty. Twenty-two tests were studied, with the following results:

1. Judd. Phloroglucinol and alkali. Limit, 1/100,000. Characteristic.

*Abstracted by Dr. Henry Leffmann.

2. Sabalitschka and Riesenberg. Similar to Judd's method, but using a stronger alkali. Limit, 1/900,000. Characteristic.
3. Weber and Tollens. Phloroglucinol and hydrochloric acid. Limit, 1/10,000. Characteristic.
4. Cohn. Resorcinol and sulphuric acid. Limit, 1/100,000, but only in a form somewhat modified from that given originally by Cohn, increasing the proportion of acid and diminishing that of the resorcinol and allowing solution to take place in the cold. Characteristic.
5. Lebbin. Resorcinol and alkali. Limit 1/10,000,000, according to Lebbin, but S. & H. find about 1/200,000 and that it is not characteristic.
6. Pfyl, Reif and Hanner. Guaiacol, apomorphin and sulphuric acid. Limit, 1/5000, and not characteristic.
7. Bonnet and Kentmann. Morphin with concentrated sulphuric acid. Limit, according to B. & K., 1/250,000, but according to S. & H. only 1/5000 and not characteristic.
8. Dané. Alpha-naphthol and potassium hydroxide. Only applicable when notable amounts are present. Characteristic.
9. Ditz. Naphthalene and conc. sulphuric acid. Limit, according to S. & H., 1/5000. Characteristic.
10. Gabutti. Carbazol and sulphuric acid. Limit, 1/10,000. Not characteristic.
11. Golodetz. Benzoylperoxidesulphuric acid. Limit, 1/10,000. Not characteristic.
12. Trillat. Aniline solution, 3/1000. Limit, 1/20,000. Not characteristic.
13. Feder. Mercuric chloride solution with sodium hydroxide and sodium sulphite. Limit, narrow. Not characteristic.
14. Arnold and Mentzel. Phenylhydrazine, with acid and ferric salt. Limit, 1/50,000. Not characteristic.
15. Arnold and Mentzel. Phenylhydrazine, sodium nitroprusside and alkali. Limit, 1/60,000. Characteristic.
16. Arnold and Mentzel. Phenylhydrazine and potassium ferricyanide. Limit, 1/50,000. Not characteristic.
17. Pilhasy. Phenylhydrazine hydrochloride with sodium acetate. Limit, 1/250,000. Not characteristic.
18. Rimini. Phenylhydrazine hydrochloride and sodium nitroprusside. Limit, 1/1,000,000. Characteristic.

19. Schryver. Phenylhydrazine hydrochloride, potassium ferricyanide and hydrochloric acid. Limit, 1/500,000. Not characteristic.
20. Fincke. Fuchsin-sulphurous acid. Limit, 1/500,000. Fincke claimed a limit of 1/1,000,000. Characteristic.
21. Hehner. Peptone and conc. sulphuric acid in the presence of a small amount of ferric salt. Limit, 1/200,000, according to Hehner, but much less according to S. & H. (1/25,000). Not characteristic.
22. Salkowski. Peptone and hydrochloric acid in presence of ferric chloride. Limit, 1/900,000. Not characteristic.

It is to be noted that the fuchsin-sulphurous acid test is stated to be characteristic of formaldehyde, yet Schiff, who first applied the solution to the detection of aldehydes used acetaldehyde, formaldehyde not being known at that time. The specific value of the solution as a reagent for formaldehyde depends upon preparing it according to the directions of H. Fincke, (published in *Zeitsch. Unters. Nahr. Genussm.* 1914, 27, 246) in which a much larger amount of hydrochloric acid is added than in the usual method and some of this acid is also added to the solution to be tested before adding the reagent. This matter is now under investigation and will be reported on later.

Sabalitschka and Harnish summarize their work by stating that when in fairly high dilution formaldehyde may be safely detected by tests 1, 2, 4, 15, 18, and 20, but that the other tests are applicable either to strong solutions or are not characteristic. It does not appear that S. & H. investigated the liability of glycerol to simulate formaldehyde in the ordinary use of fuchsin-sulphurous acid in testing for methanol as LaWall has shown.

KEKULÉ AND HIS HEXAGON*

By Henry Leffmann

FEW SUGGESTIONS in theory have been more fertile in developing both pure and applied science than the suggestion of the six-carbon ring for the structure of benzene. The story of this hydrocarbon has a tinge of romance. It was first prepared in 1825 by Faraday, in the course of some investigation of compressed illumi-

*Reprinted from the *Bulletin* of the Wagner Free Institute of Science.

nating gas. He determined its composition to correspond to the formula C_2H ($C = 6$) and called it "bicarburet of hydrogen." Mitscherlich in 1834 obtained it by distilling calcium benzoate and called it "benzin." Later, A. W. Hofmann, working in England, found it in coal-tar. His pupil Mansfield prepared samples of it from that source. Mansfield lost his life in an accident while preparing a sample for exhibition at the Paris Exposition of 1854. The earlier workers overlooked the sulphur compound (thiophene) associated with it in tar and for some time the homologous hydrocarbons, such as toluene and the xylenes, were not clearly distinguished.

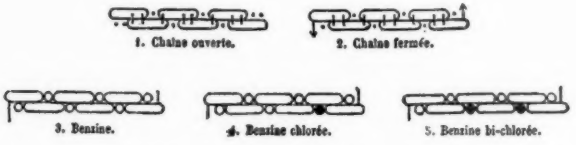
Before the middle of the 19th century organic chemistry had begun its phenomenal rise. The conversion of ammonium cyanate into urea had shown the inapplicability of the definition limiting organic chemistry to the products of vital action, and Berthelot's extensive researches in synthesis had widened the breach. Wurtz' discovery of the compound ammonias was a further important step. Berzelius' electrochemical theories seemed to be antagonized by the discovery of the comparatively easy substitution of the halogens for hydrogen in the hydrocarbons and their derivatives. The theory of hydrocarbon radicals grew into favor and then came, among other suggestions, the "type theory," which had an extensive and useful vogue. Most of the work concerned the series now termed aliphatic or open-chain, but experiments with benzene were carried out and somewhat enigmatical isomerisms began to appear.

Friedrich August Kekulé was born in 1829 and died in the summer of 1896. A summary of his scientific career and work is given in the memorial address delivered before the German Chemical Society at the meeting of July 27, 1896 (*Ber.*, 1896, **29**, 1971). His life, outside of his earnest and active chemical researches, seems to have been uneventful. As with many German chemists at that time and with some British and French chemists, attention was given to the theories of molecular structure. Three types of compounds were recognized under the "type theory" then in vogue: hydrogen, water and ammonia types. To these Kekulé added the marsh-gas type, and many aliphatic compounds were thus conveniently arranged.

In 1858 Kekulé was called to the University of Ghent and began his most active work in organic chemistry, resulting in the publication in the early 60's of his text-book of organic chemistry. He developed the type theory, out of which grew naturally the doctrine

of valencies. He suggested the tetravalent capacity of carbon and explained the formulas of the members of the open-chain homologous series by the self-saturation of the carbon atoms, in accordance with the methods now generally adopted and familiar to chemists.

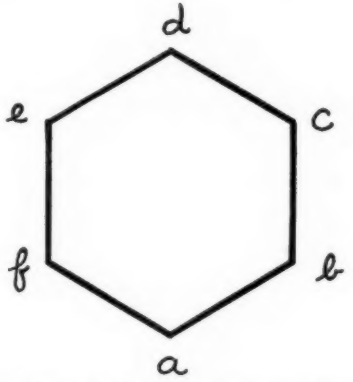
The benzene derivatives could not be explained on the open-chain theory. In 1865, Kekulé prepared a paper which curiously was presented first to the Chemical Society of Paris, and read by Wurtz. The title was, "On the Constitution of Aromatic Substances." It covers about a dozen pages in the *Bulletin* of the society and contains adumbrations of the hexagon, bearing at first sight little resemblance thereto. Herewith are given reproductions of a few of the figures. It was really as far back as 1859 that Kekulé had suggested some phases of these stereochemic formulas. The paper on the constitution of aromatic substances was republished with material additions in *Annalen* (1866, **137**, 1, 129). The hydrocarbons of the aromatic series then known were usually referred to benzene



Kekule's original stereochemic formulas as given in *Bull. Soc. Chim.*, 1865, n. s., 4, 108

as a type, and in addition to the formulas given above, he suggested the now well-known generally accepted hexagon, standing when unmodified for C_6H_6. The valencies in excess of those required for the hydrogen were disposed alternately as one and two between the carbons. We may note in passing what difficulty would have arisen if the old atomic weight of carbon on which Faraday based his formula had been retained, by which benzene would have been $C_{12}H_6$. Kekulé's arrangements not only explained the structure of the homologues of benzene, but also showed the existence of three isomeric forms in all di-, tri- and tetra- substitutions, when the substituting radicals are the same. These views were put forth with caution and reserve that seem rather unnecessary at the present time, but we are reminded of Darwin's caution and reserve concerning suggestions in the "Origin of Species."

It was in the paper in the *Annalen,* which, as noted above, was more extended than the original as read in France, that Kekulé made the suggestion of the hexagon, which was figured as above. It is worthy of note that it is a regular figure. For some reason chemists have fallen into the habit of making the two verticals longer than the other sides. To aid in explaining the isomerism, the letters were attached to the angles. A better system of numbers clockwise has supplanted this original suggestion.



Kekulés suggestion of the hexagon as given in *Annalen* (see reference above)

Kekulé gives the following enumeration of the possible isomers in the successive substitutions of the hydrogen by one or more identical radicals, using the bromine substitutions as specific examples:

Monobromobenzene	one form
Dibromobenzene	three forms, *ab ac ad*
Tribromobenzene	three forms, *abc abd ace*
Tetrabromobenzene	three forms, similar to the di-forms
Pentabromobenzene	one form
Hexabromobenzene	one form

The hexagon is often written wrongly, groups CH being placed at the angles—such an arrangement represents *additive* compounds. The plain hexagon stands for C_6H_6. Hexagons are often shown with alternate double and single linkings, but this is also wrong. The

exact manner in which the extra valencies are saturated is in dispute, and no theory in regard to it should be involved in the ordinary formulation of aromatic hydrocarbons and their derivatives. Full representation of the stereochemistry of any molecule cannot be shown except tridimensionally, that is, with models. For instruction at the Wagner Institute I prepared tetrahedrons of black cardboard, six inches on the side, with small hollow caps of different color which fit on the angles. By this means a very satisfactory explanation of the isomerisms can be shown.

A DIAGRAMMATIC REPRESENTATION OF HYDRION CONCENTRATION*

By Max Trumper

THE TERM hydrogen-ion concentration was introduced into chemistry a number of years ago, but has only in the last few years become familiar to physicians. It is commonly abbreviated by American writers as above (hydrion concentration).

One of the first difficulties with a subject of this type is the appreciation of the unit of measurement. In anatomy the student can note the general features with the unassisted eye. Even in histology and bacteriology we soon accustom ourselves to think in terms of microscopic measurements although we cannot actually conceive the small fractions of the inch or millimeter that are given. In dealing with atomic magnitudes and especially with the smaller divisions, electrons and protons, there is a liability to lack of appreciation of the scale. The step from gross to cellular structure is short, indeed, compared with that to the realm of molecules, atoms and electrons.

It is necessary to change the basis of the unit of any scale in relation to the magnitudes measured. The mile suffices for ordinary land measure, the inch for many common objects, but the microscope deals with small fractions of this or with millimeters. In modern physical chemistry, higher mathematics finds very frequent application, and in expressing the degree of hydrion concentration a special application of mathematics is made, though fortunately not a very high phase.

*Reprinted from the *Bulletin* of the Wagner Free Institute of Science.

By hydrion concentration is meant the proportion of an acid or alkali in solution which has received electrical charges. Each acid and alkali, when dissolved or melted, suffers a change by which one part of its molecule assumes a charge of positive electricity and the other a negative. The two portions are termed "ions." The atom or group that assumes the positive charge is called the "cation" and the negatively charged one the "anion."

It is not intended here to explain at length the nature and importance of hydrion concentration, but to present a diagram showing concisely, and it is believed vividly, the relation of the acid and alkaline conditions and the nomenclature and notation of each step in the decimal increase or diminution of concentration. The symbol for hydrion concentration has been differently written, but American chemists are mostly agreed on pH and this form will be used here:

This number to express proportion is based on the fact that pure water under normal conditions ionizes itself, producing 1 gram of ionized hydrogen in 10,000,000 liters. Expression of this will be the hydrion concentration. The method adopted is to take the logarithm of this fraction. The logarithm of 1/10,000,000 is minus seven (-7). If the solution is ten times as strong, the logarithm would be -6, and so on. In practice, the minus sign is omitted, with the somewhat awkward result that as the amount of ionization increases the figure decreases, hence pH_3 represents a much stronger ionized solution than pH_7. Further, if the ionization of the hydrogen falls below 1 gram in 10,000,000 liters, it can be only by some increase of an opposing (negative) ionized atom or group. This is usually HO, the characteristic and active group of alkalies. In accordance with the above rule, this increase of negative ion diminishing the effective activity of the positive ion represents a greater dilution of the latter and hence a higher minus figure, but the minus sign being omitted as usual, the figure stands, for example, pH_8, which marks a diminution of the hydrogen-ion concentration by ten times that of pH_7. Proceeding in this way by adding substances containing hydroxyl ions, of which the common alkalies are the best representatives, we gradually reach a point in which the alkalinity is equivalent to and will exactly neutralize the hydrogen-ion concentration of pH_0. This alkalinity is represented by the figure pH_{14}.

The following synopsis shows this:

		pH_7(Neutral) N/10,000,000	
Acidity			**Alkalinity**
	pH_6	**N/1,000,000**	pH_8
	pH_5	**N/100,000**	pH_9
	pH_4	**N/10,000**	pH_{10}
	pH_3	**N/1,000**	pH_{11}
	pH_2	**N/100**	pH_{12}
	pH_1	**N/10**	pH_{13}
	pH_0	**N/1**	pH_{14}

Practically all the body fluids are represented by large unwieldy figures near the apex of this graph and so a short way of writing them is to use the negative power of ten to express the denominator. The abbreviation pH stands for the power (logarithm) of the number expressing the concentration of hydrogen ions. For example, the hydrogen-ion concentration of normal blood is about .000,000,04N, which in its abbreviated form is pH 7.39.

SCIENTIFIC AND TECHNICAL ABSTRACTS

SUGAR FROM SAWDUST—A process for manufacturing sugar out of wood, which Professor Friedrich Bergius of Heidelberg University has worked out in the laboratory, has now reached a state where it may be utilized in industrial production on a large scale. A large factory to carry out the process is being erected near Geneva, Switzerland, by the International Sugar and Alcohol Company of London. It is estimated that an acre of forest land can be made to yield as much sugar as an acre of ground planted to sugar beets, and the new process has the advantage in that it can be carried out completely and continuously by machinery without the employment of the manual labor and the length of time necessary for crop production.

The synthetic sugar, however, is not the same as the sucrose made from beets or cane, but is rather like the glucose now made in

America by the action of hydrochloric acid on cornstarch. Glucose is not so sweet as sugar, but is equally nutritious. The product of the Bergius process comes out in the form of a grayish powder, containing 95 per cent. sugar. This can be used directly for cattle food or be purified for human use.

The process consists essentially in adding a molecule of water to each molecule of the cellulose of the wood pulp, which converts it to glucose. This is accomplished by treating sawdust with 40 per cent. hydrochloric acid in containers specially constructed of acid-proof and heat-proof materials. Earlier efforts to effect this transformation economically were frustrated because the acid was used in dilute solution, and afterwards, in driving off the excess of water, much of the sugar decomposed. In the present process the acid is recovered in concentrated form ready for renewed use without the expense of distillation. The necessary heat to evaporate the water from the mixture is introduced by the injection of hot vapors of mineral oil. This does not absorb the volatile acids and does not mix with the sugary solution, but floats as a layer on top and so can be easily separated. The oil is reheated and run in with more of the sugar cellulose solution.

The Bergius process for synthetic sugar was patented in the United States on July 28, 1926.

METRIC VICTORY FORECAST FOR 1927—That the United States during the present year will take final legislative action to place its merchandising on the decimal metric basis in weights and measures was the declaration made at the annual executive conference of the All-America Standards Council, held in San Francisco, January 6th.

> "Metric legislation is now prominent before both houses of Congress," stated Aubrey Drury, director of the Council, "and when a vote is called, victory appears assured for the metric standards, which are on the convenient decimal ratio, like our dollars and cents currency. A recent canvass of the United States Senate has indicated an almost certain majority for metric adoption.
>
> "Obstructionists have always fought bitterly to kill in committee any metric action. The great basic strength of this issue in Congress was shown the one and only time it was allowed to come up for a general vote. In the House of Representatives, the Stone Metric Bill successfully passed two of the necessary

three readings, but after a dispute on rules of order it was recommitted to the Committee on Coinage, Weights and Measures, on request of its author, with expectation of a later vote, indefinitely delayed. The metric legislation was never defeated in a general vote in Congress. It can and will win in the 1927 vote.

"The metric issue has won overwhelming victories in more than forty of the great parliaments of the world. At one time a metric standards bill passed the House of Lords in Britain; at another, lacked only five votes to win in the House of Commons. The House of Representatives in Australia has endorsed the decimal weights and measures by a vote of 36 to 2. All civilized nations except the United States and the British Commonwealths are now on the metric basis in merchandising, and British units are largely different from ours."

Declaring that decimal metric weights and measures for the United States have been endorsed by seven Congressional committees, but with never a general vote in Congress, metric advocates throughout the country are urging a "show-down" in 1927 and predict a definite victory at the roll-call.

THE RESEARCH SPIRIT—The manager of a high-grade research laboratory has nothing to learn from the manager of a traveling long-haired virtuoso. A machine-tool operator, with proper instructions and strict inspection, can turn out about the same number of satisfactory pieces per day, whether he feels buoyant or is sorry that he was ever born. A researcher, on the other hand, is expected to see what others before him have been unable to see. He is expected to exercise infinite pains, to cooperate with every one within reach, to attend to his own education and development in his spare time, and to know how to strike a happy balance between a thorough fundamental inquiry and getting immediate results. He must learn to acquire depth without losing breadth. He looks to the manager not as to a boss to prod him along (most researchers are apt to overwork, anyway), but as to one to assist him in getting the necessary materials and help, to rejoice with him in his success, and to console him when a pet scheme, after years of persistent effort, finally fails to work.

Consider three types of research managers—the "never was" type, the "has been" type, and the "is" type. The first type has to go entirely by guess as to what is best, the second is handicapped by the "in-my-time" attitude, and the third is apt to neglect managerial duties or to impose his own views too much.—*Electrical World.*

MEDICAL AND PHARMACEUTICAL NOTES

POISONING GERMS—The synthetic drugs of modern chemotherapeutics act as "shock troops," and the antitoxins which they induce the body to form are the "mopping-up squads" in the battle against invading bacteria.

This, broadly stated, is the kernel of the theory of the action of such products of the dyestuffs laboratory as salvarsan and Bayer 205 advanced by Dr. Wilhelm Roehl, expert of the Elberfelder Farbwerke. "The first action of chemotherapeutic substances," he said, "is directly upon the germs themselves, poisoning them. The autonomic production of antitoxins by the body, which the drugs induce, is of secondary importance but valuable for the final destruction of the bacteria previously damaged by the chemotherapeutics."

The theory of the chemical action of synthetic drugs containing arsenic advanced by Dr. Paul Ehrlich, the inventor of arsphenamine, best known of such arsenicals, was discussed by the assembled scientists. Though such drugs are of extremely complex chemical structure, their final action on disease germs, according to Dr. Ehrlich's view, is similar to that of the common arsenic used in rough-on-rats or in the too-popular present-day murder mysteries. The famous German scientist holds that the complicated organic arsenic compounds act by the reduction of the arsenic acid group they contain to arsenic oxide. He also holds that organic drugs containing antimony, vanadium, bismuth, mercury, silver, gold and platinum act in a similar manner.

USELESSNESS OF INSULIN BY INUNCTION—Recently, cases of fatty atrophy following long-continued use of insulin have been reported. These and other less important disadvantages have made it desirable to find methods of administering insulin other than by the subcutaneous route. Attempts to give insulin by mouth, perlingually, by duodenal tube, intratracheally, by inhalation, and by rectum, either in solution or in suppositories, have given results which in the main are either mechanically difficult, inconclusive, inconstant, or wasteful of the drug. Experiments with insulin by inunction were made as early as 1922. Contradictory results of subsequent work along the

same line impelled Harrison's recent investigations "to decide whether insulin inunctions would be of any value in the treatment of human diabetes." Four observations were made on two diabetic patients. Although the number both of observations and of patients is small, the work was admirably controlled. As much as 1000 units of insulin dissolved in almond oil was rubbed for a period of one hour into the skin of the abdomen, chest and arms with entirely negative results. Other bases used for the suspension of the insulin were hydrous wool fat and a dilute solution of alcohol and glycerol. Another observation in which 100 units of insulin suspended in hydrous woo! fat was rubbed into the skin of the shaved abdomens of two rabbits was contributed by Dr. J. H. Burn. His results, likewise, were negative. On the basis of this evidence the conclusion must be that insulin inunctions "are useless as a therapeutic measure."—*Jour. Amer. Med. Assoc.*

THYROID HORMONE NOW MADE IN LABORATORY.—Thyroxin, the hormone of the thyroid gland, has been made synthetically for the first time in the laboratories of University College, London, according to reports just received by the American Medical Association.

Dr. C. R. Harington and Prof. George Barger are the workers who have achieved this result from researches supported by funds supplied by the Rockefeller Foundation to the University College Hospital Medical School in 1920. The hormone, which is used in treating patients with a defective thyroid gland, was first isolated by Dr. E. C. Kendall, of the Mayo Clinic, in 1917. Its production synthetically from coal-tar products and iodine will assure an absolutely even standard, medical authorities say, and should have the effect of making the price much lower.—*Science Service.*

DISEASE GERMS HAVE VIRULENT AND NON-VIRULENT FORMS —New conceptions of how immunity is developed against germ-caused infections, that may have far-reaching effects on the protection of the human race against disease, were recently reported to the American Society of Bacteriologists by Dr. Philip Hadley of the University of Michigan.

According to the older views, it was thought that all the bacteria of a particular specific kind must necessarily be alike in all their characteristics. Recent work, however, has shown, said Dr. Hadley, that

"in one and the same bacteria culture organisms of vastly different potentialities for disease production may exist side by side."

"At present, many disease-producing species may be divided into two distinct types; one that is virulent that possesses certain individual properties and is called the 'S type,' and another that is non-virulent, or at least less virulent, that possesses other characteristics, and is known as the 'R type.' The most important difference between the two types lies in the fact that the 'S' form resists the onslaughts of the defensive cells of the blood known as the phagocytes while the other form is readily destroyed by them."

Change from one form to the other may be produced artificially in test tubes in the laboratory, Dr. Hadley stated. The most potent factor in inciting such changes has been found to be blood or serum from an animal which has been inoculated with the culture of the organism in question. In the presence of such serum the virulent form "S" passes over into the non-virulent form "R."

The importance of being able to bring about such an action in the bodies of animals and human beings suffering from bacterial infection is at once apparent.

"This possibility would open a new field in therapeutic endeavor, in so far as we should search, not necessarily for germicidal substances to kill the bacteria in the body, but for substances which will incite the dissociative reaction in whatever tissues the organisms may be located," Dr. Hadley said. "That such substances may not need to be in themselves germicidal is best indicated by the influence of immune serum which, though only slightly germicidal, is more strongly dissociative than any substance yet studied."—*Science Service.*

NEWS ITEMS AND PERSONAL NOTES

OBITUARY

DR. HERMANN D. ENGELHARDT. Dr. Hermann D. Engelhardt, for the past thirty-two years head of the Analytical Department of Sharp & Dohme, died, February 9, 1927, at his home in Baltimore.

Dr. Engelhardt was born at Braunschweig, Germany, in 1863. He attended the private schools and the Polytechnikum of Braunschweig, entering the University of Gottingen in 1882 and later attending the University of Leipzig.

He received the degree of Doctor of Philosophy from the University of Erlangen in 1888. After five years' service as a chemist in the dye industry in Hesse, Dr. Engelhardt came to the United States in 1895 and entered the service of Sharp & Dohme.

Dr. Engelhardt was a member of the Revision Committee of the National Formulary, American Pharmaceutical Association, Maryland Pharmaceutical Association, American Chemical Society, American Association for the Advancement of Science, Steuben Society and Engineers Club.

He is survived by his widow, one daughter, mother and two sisters.

REV. HERMAN F. COOK. A few days following the death of his beloved wife, Rev. H. F. Cook, father of Professor E. Fullerton Cook, died of post-operative complications at a Wilmington, Del., hospital. Professor Cook and his family are in Europe.

The JOURNAL extends its deepest sympathy to the bereaved children.

PHILADELPHIA COLLEGE OF PHARMACY AND SCIENCE STARTS NEW BUILDING—The Board of Trustees of the Philadelphia College of Pharmacy and Science at its regular meeting on March 1st authorized the Building Committee to start immediate construction of the new college building on the site at Forty-second, Forty-third, Woodland and Kingsessing Avenues, which was acquired several years ago. The building will be three stories, in the Georgian style of architecture, and will accommodate not more than eight hundred students, including all regular and special classes.

The architect's name is Norman E. Hulme. The chairman of the Building Committee is Dr. Otto W. Osterlund, president of the Belmont Trust Company.

Ground will be broken immediately, and the building will be completed in about nine months. The building is to cost about $600,000.

The Alpha Sigma Society of the Chemistry Department of the college offered to furnish a suitable inscribed cornerstone for the new institution, and the offer was accepted by the Board of Trustees of the college.

Many other individual gifts from alumni and groups of alumni are expected.

LIMITATION OF ENTRANCE CLASS AT PHILADELPHIA COLLEGE OF PHARMACY AND SCIENCE—The Board of Trustees of the Philadelphia College of Pharmacy and Science authorized the Committee on Admissions to reduce the number of entering freshmen for the next session from 300 to 250 in the interests of better education.

DIPHTHERIA TOXOID—Diphtheria Toxoid, also known as Diphtheria Anatoxine-Ramon, is a non-toxic modified diphtheria toxin, used for active immunization against diphtheria. It is described as being prepared by the action of formaldehyde on diphtheria toxin, and as being free from serum proteins.

The results of immunization are very similar to those obtained with the toxin-antitoxin mixture, the chief difference being that protection develops more rapidly after the use of Toxoid.

Diphtheria Toxoid produces an active immunity in from three to eight weeks, or about one-fourth the time required with Toxin-Antitoxin Mixture, and a certain degree of immunity is produced even sooner.

Diphtheria Toxoid is available through the Mulford Laboratories, who offer it not as a substitute for Toxin-Antitoxin Mixture, but rather in keeping with their reputation as the pioneer biological laboratories and to meet a certain demand which exists for this product.

Those interested in Diphtheria Toxoid may obtain a descriptive circular upon request to H. K. Mulford Company, Philadelphia, Pa.

BOOK REVIEWS

CHEMISCHE TECHNOLOGIE DER ORGANISCHEN VERBINDUNGEN (Chemical Technology of Organic Compounds). A text-book edited by Dr. R. O. Herzog, assisted by numerous collaborators. 2d revised edition, xii-997 pages, 461 illustrations in the text. Carl Winters University Book-shop, Heidelberg, 1927. Paper bound, 66 marks.

The editor of this work is director of the Kaiser Wilhelm laboratory for textile chemistry in Berlin, and his more than two score collaborators are mostly Germans, with a few from other European

countries. They are all specialists in the subjects on which they write. It may be still true that only in Germany could such a thorough treatise be written. Chemical technology has for nearly a century gone hand in hand with theoretical study among the Teutons, and has yielded them enormous returns both sentimentally and practically. The other great nations that have so lately competed with Germany on the field of battle have learned some lesson as to the value of pure science in its relation to practical work, but it is to be feared that the lesson may not have been learned thoroughly enough.

However that may be, the reviewer's duty is with the volume in hand. Considerable time has elapsed since the first edition was issued, and every chemist knows how rapid has been the advance in every department of the science. War placed a positive ban on the cosmopolitan spirit that science workers felt was about to be realized, and left chemists especially arrayed against one another, and devoted not to conservation but to mutual destruction. The appearance of war-gases brought the laboratory in direct touch with the battlefield. Can we hope, asks Dr. Herzog in the preface, for a return to the freedom of science from national boundaries? Possibly technology is too closely interlocked with economic issues to be kept out of the shackles that are enveloping the world. Let us hope for the best. The first edition of the book was issued in 1912. The long interval of almost fifteen years must, however, be interpreted in the light of the terrible events from the summer of 1914 to the late fall of 1918. While it appears clearly that Germany kept up its general methods of scientific work, yet a diversion to certain features necessarily occurred. Some changes in plan have been made in the preparation of the second edition, but the principal modifications are in adding new matter, among which is a section on the derivatives of acetylene.

It is not necessary to speak in detail of the merits of the work or of its usefulness to the chemist engaged in industrial procedures. Its comprehensiveness may be appreciated by the list of sections, as follows: Bitumens and tars. Fats, oils and waxes. Resins and rubber. Carbohydrates, including paper-making. Fermentation industries, including the manufacture of lactic and acetic acids. Proteins, including all methods of tanning, and the manufacture of milk products. Coal-tar colors. Ethereal oils and perfumes. Pharmaceutical products, including synthetic preparations. Explosives. Photographic materials. A section on special materials such as the more

important vegetable acids, extraction liquids and their recovery. Large space is devoted to the technology of textiles covering many phases of the manufacture of these materials. This section covers nearly two hundred pages. The final section is on the question of purification of industrial wastes, embracing a little more than a score of pages, so that only the outlines of this most important department of public hygiene can be included.

Much more space than can be given would be required to set forth the contents of this book. It is a wonderful production and it is somewhat astonishing that Germany can find opportunity for so elaborate a treatise so soon after the devastation of war, but the nation has always shown thoroughness and earnestness in all its productions.

The illustrations are very numerous and add greatly to the value of the book.

HENRY LEFFMANN.

THE MEANING OF A LIBERAL EDUCATION. By Everett Dean Martin, Director of The People's Institute, New York; Lecturer The New School for Social Research. Octavo, 319 pp., cloth $3. W. W. Norton & Co., Inc., New York.

Most books that deal with the subject of education, and there are many, are concerned with the training of our young men and women. Much is said about educational methods, but very little about content. There is also discussion of the effectiveness of institutions, schools and colleges, and the interest of the State in education. The book before us does not deal with such matters. It is concerned with other, more important problems. What is an educated person like? How does he differ from the uneducated?

The theme of the book is that education is more than information or skill or propaganda. It gives the essentials of a liberal education. The author has written this excellent book, not from the standpoint of the professional educator, but from the standpoint of one who is concerned that his own education shall not stop in middle life. No one is fit to be a teacher whose own mind does not continue his own education. One is a student first and then a teacher. The best teacher is the seeker after truth among his students.

I can highly recommend this book to pharmacists, students and professors.

OTTO RAUBENHEIMER, PH. M.

HANDBUCH DER BIOLOGISCHEN ARBEITSMETHODEN. Von Geh. Med. Rat Prof. Dr. Emil Abderhalden. Abt. IV Angewandte Chemische und Physikalische Methoden. Teil 7 : Pharmakologie, Pharmazie and Toxikologie. Lex. Urban & Schwarzenberg, Berlin and Wien.

This monumental and classic work by Prof. Dr. Abderhalden, director of the Physiological Institute at the University of Halle, together with over 400 co-workers, is gradually nearing completion. The scope of the entire work can be appreciated from the following thirteen divisions: I. Chemical Methods; II. Physical Methods; III. Physical-Chemical Methods; IV. Applied Chemical and Physical Methods (the volume just completed and before us); V. Applied Chemical, Physical, Physical-Chemical and Biological Methods; VI. Methods in Experimental Psychology; VII. Methods in Comparative Morphological Research; VIII. Methods in Experimental Morphological Pathology; IX. Methods Applied in Animal Metabolism; X. Methods in Geology, Mineralogy, Palæobiology and Geography; XI. Methods Applied in Plant Organism; XII. Methods Applied in Uni-Cellular Organism, and XIII. Experimental Therapy. What a variety of subjects! What a comprehensive and systematic arrangement! What a master-work! Truly a credit to the German scholar and his able assistants and also to the firm which undertook the publication of such a colossal work. The author states in the preface that the work is a document showing the status of the entire biological sciences at the present time. Very true. The work is a practical handbook and an authoritative reference book!

The part before us, Applied Chemical and Physical Methods of Pharmacology, Pharmacy and Toxicology, contains a great many subjects of interest to pharmacists; for instance: Detection of Poisons by Chemical Methods, by Wilhelm Autenrieth in Freiburg; Detection of Poisons by Pharmacological Methods, by H. Frechner in Leipzig; Detection of Poisons by Physical Methods, by Th. Sabalitschka in Berlin; Bio-Assays, by Storm van Leeuwen in Leyden; Toxic Doses, by F. Flury in Wuerzburg; Analysis of Pharmaceutical Specialties

(Patent Medicines), by H. Bauer in Stuttgart; Synthesis of Medicaments, by S. Fraenkel in Wien, etc., etc.

The volume before us is a master-work and above all a practical handbook. It should be used by investigators and research workers in all the different parts of the entire world. It should be in the libraries of colleges of pharmacy and other educational institutions. Abderhalden deserves credit and the thanks from pharmacy, chemistry and medicine. The Handbuch der biologischen Arbeitsmethoden is a library in itself!

OTTO RAUBENHEIMER, PH.M.

FOUR THOUSAND YEARS OF PHARMACY. On outline of the History of Pharmacy and Allied Sciences. By Charles H. LaWall, Ph.M., D.Sc., Pharm. D., F. R. S. A. Dean of the Philadelphia College of Pharmacy and Science. 8vo., xv-665 pages. Many illustrative plates. Philadelphia, J. B. Lippincott Co. $5.00.

"History," said Edward Gibbon, "is little more than the register of the crimes, folies and misfortunes of mankind," and speaking further of the paucity of events during the reign of the Antonines, he agreed with the maxim that the country is happy that has no history. Gibbon's views were close to full truth as history was written in his day, but a different story must be told today. History has taken on an active scientific method. True, the reform is not complete; we cannot say with Sganerelle, "Nous avons changé tout cela," but much has been accomplished to put historians out of the field of mere chroniclers and oblige them to present the picture of any period by scientific and philosophical principles.

About the middle of the last century, Thomas H. Buckle published a book in which he emphasized the relation of the "aspects of nature" to civilization. A few years later, Carl Marx in his book "Capital," argued for the importance of economic motives and gave the world the theory commonly known as the "materialistic conception of history." Throughout the greater part of the history of the world, of which we have written records, a distinct separation existed between academic and practical workers. The artisan was excluded from association with the philosopher. The co-operation of the research worker and the practical man, so characteristic of our present industrial civilization is a very recent development.

Socrates once asked his disciples why astronomy is a proper subject for study. Several reasons were given, referring to the practical value of a knowledge of the positions and movements of the heavenly bodies in connection with navigation and chronology. The sage smiled sarcastically, deprecated the encomiums on the "practical" values, and added that the main reason for studying the heavens is the ennobling influence upon the mind.

Enough of these "obiter dicta," "wayside speeches." Here is a worthy book, product of many months' "patient search and vigil long" among dusty tomes and musty records. How many spores of *P. glaucum* and *A. niger* have been scattered about the author's library during this work cannot be told, but the wife has probably a recollection of the conditions that the search caused. We learn, however, from the dedication that she has not *expressed* any complaint. Obviously the author has, like Fitz-Eustace,

> ". . . . . pored
> O'er many a huge romantic tome,
> . . . . . .
> Imprinted at the ancient dome
> Of Caxton or De Worde."

Pharmacy is too intimately connected with chemistry on one side and with medicine on the other for a comprehensive history to avoid frequent reference to both. The relation of the pharmacist to the physician has always involved disciplinary difficulties. Pharmacists look with disfavor on doctors who furnish their own medicines and doctors are loud in their condemnation of counter-prescribing. It is not for the historian of either science to discuss these problems.

To trace the development of a science or social movement through four milleniums is no easy task. The author of this book has searched the records on stone, clay, papyrus, parchment and paper and culled from these extensive sources, such incidents and narratives as illustrate the progress from the crude methods and ideas of man in the morning twilight of civilization to the present day on which (we flatter ourselves) shines the light of true knowledge. Written in a scholarly style, without pedantry or affectation, the text carries the reader forward through the periods of ebb and flow of human intelligence in the successive ages. Alchemy necessarily claims much attention. The pursuit of the secret of changing the baser metals into gold was associated with other earnest searchings, the universal solvent and the elixir of life.

The text is supplemented by many photo-engravings of title pages and other illustrations from old books and manuscripts giving the reader a vivid idea of the nature of the "quaint and curious volumes of forgotten lore" which enrich the author's library and from which he has condensed a story that fastens the interest and commands the attention of the reader from beginning to end.

The book is a most valuable and opportune contribution to scientific history as well as to the history of science. The saving grace of humor which the author possesses in high degree with the liberal spirit both in philosophy and science adds to the interest and value of the text and makes the book not only a chronicle of events but a contribution to the highest phase of literature.

Though reviewers commonly use the plural pronouns in company with monarchs, editors and governors, as the old grammars used to tell us, they are but human, and it is impossible for them to pass a book without looking for something upon which to animadvert. It is to be feared that La Rochefoucauld was right when he said that there is something in the misfortunes of our best friends which does not wholly displease us. To enjoy the reviewer's pleasure of picking flaws, an earnest search was made in this book. There are certainly very few of them, for great care has been taken to refer to the basic authorities and to quote correctly, yet two errors have been found, one of fact and one of attitude. In presenting comparison between the antiquity of some of the early papyrus manuscripts and the manuscripts of the Bible it is stated that one of these latter dates from the middle of the fourth century and contains the New Testament and the other, containing the Old Testament, is of a much later date. As a matter of fact, there are two great codexes, the one in the Vatican Library and the other in the library at Leningrad. Both of these contain portions of the Old and New Testament and they are about the same date, in fact the one in Russia contains the New Testament complete.

The reviewer takes issue with Dr. LaWall's interpretation of the Galileo incident. His account would lead one to believe that the authorities in Rome were the only ones antagonistic to the Copernican theory and that Galileo was pursued with bitter hostility and vindictiveness. Francis Bacon did not accept the theory and Luther and Melancthon bitterly denounced it. The truth seems to be that if Galileo had confined himself to what was then the proper method of presenting scientific discoveries, namely, to write his view in

Latin and circulate it only through the intellectual world, he would have had but little trouble; but he chose to take sides in a broader field and to attack the Roman Church's interpretation of Scripture. We may picture the situation somewhat by considering the present quarrel over the teaching of evolution. In Galileo's time, the Copernican theory was not as established as it is today. It contradicts the evidences of our senses and it requires much thought and training to realize the true nature of the celestial movements. Similarly today text-book writers and lecturers have rashly presented in elementary instruction the theory of evolution as if it presented no difficulties. The result is a revolt against science which is painful to those who are anxious to distinguish between what is known and what is simply supposed.

These errors are trifling and do not diminish the value of a book which will do much to inform a wide circle of readers of the struggles of pharmacy in itself and in its relations from earliest known periods.

HENRY LEFFMANN.